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THE STUDY OF A SMALL AND ISOLATED COMMUNITY IN THE BAHAMA ISLANDS.

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SINCE the Bahama group of islands lies between 21° and 27° north latitude, it will appear that they are chiefly sub-tropical, but for the purposes of this paper they may be considered as practically tropical. The writer's experience was gathered from a residence on Green Turtle Key throughout the month of June, 1886, he having had the good fortune to make one of a party of biologists who sailed under the auspices of the Johns Hopkins University in May. It will be remembered that the Bahamas consist of several small islands without much vegetation, some thousands of rocks, and a few larger islands, the most important of which is Abaco. The majority of the keys, as the smaller islands are called, are uninhabited. Green Turtle Key, on which our party took up residence, is within about two miles of Abaco, which latter is known locally as "The Main." Green Turtle Key, about a mile in length by a quarter of a mile in greatest breadth, is the residence of some six hundred people, who are gathered together on the widest end of the island, and have formed a picturesque little village, with its streets on the solid white limestone, its alleys, its garden-plots, its shops, its school, and its churches.

The Bahamas as a whole have a common origin, as coral formations, and all the phases of the growth and changes of coral reefs and islands may be studied here. But this has

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already been done by others, and the writer purposes in this paper to attempt what he believes is a new task,—a description of the life of a small and almost wholly isolated community of Anglo-Saxons and Negroes in a tropical or sub-tropical region, from the point of view of biology, psychology, and physiology (or medicine); for it seems to him that the conditions are here furnished for the solution, in great part, of certain highly interesting problems. The briefest possible glance at the history of the Bahamas will make the general treatment of the subject clearer.

Columbus, who visited St. Salvador (either Cat or Watling Island), thus wrote to Ferdinand and Isabella of the natives:

"This country excels all others as far as the day surpasses the night in splendor; the natives love their neighbors as themselves; their conversation is the sweetest imaginable; their faces always smiling; and so gentle and affectionate are they, that I swear to your Highness there is no better people in the world."

This simplicity made them a prey to the perfidious Spaniard; and forty thousand of them are said to have been transported in 1509 to the mines of Hispania.

The English visited the Bahamas in 1629, and soon took possession, on the plea of ridding them of the pirates with which they were infested. In 1718 the first crown governor was appointed; and soon after the pineapple was introduced into New Providence.

During the American war of independence many colonists took up residence in the Bahamas, bringing their slaves with them; and cotton was largely cultivated, till the entire crop was, in 1788, destroyed by the red bug. In 1834 slavery was abolished by purchase.

In 1865 blockade-running was common. Wrecking had been prevalent, but gradually declined, though it has left a decided impress on the present inhabitants.

How do the natives gain a subsistence, and what does that subsistence imply?

Abaco, though a large island, is sparsely inhabited, mostly by negroes, for "swamp fever" (malaria) in a severe form is common; Green Turtle Key is, however, free from any prevailing form of disease, as the island is, throughout, high enough to escape stagnant water. The population on this key consists of Whites, mostly of English descent, many of them retaining the characteristic accent of their forefathers, and of Blacks, the de-

scendants of the slaves of former times, in about equal proportions. The two races co-operate in perfect harmony for the general good; the Black accepting an inferior *status* in society without a murmur. The best part of the town and the more eligible dwellings are occupied by the Whites, it need hardly be said; but all mingle together in the school and the church. The principal sources of income are pineapple-culture and the sponge-fishery. The government introduced the pineapple and sold the land at a price so low that all could purchase "plantations;" so that most of the natives, whether black or white, either have, or had originally, plantations of larger or smaller size. I have been informed by a gentleman engaged in the fruit trade that about fifteen or twenty vessels are loaded, during the summer months, with the pineapple; the average value of a cargo being about two thousand five hundred dollars. This would make a total of, say, forty thousand dollars, to be distributed among six hundred people; which would give less than seventy dollars to each, even assuming that the whole was thus divided, which is not the case, since the shippers' profits are to be deducted; and the natives complain loudly of the low price given for the fruit. Reckoning that an equal amount is derived from "sponging," the total income would still be very small. It is to be remembered, too, that though bananas abound, and of cocoa-nuts there are enough, these are not exported. Of the large variety of fruit-trees growing wild, often entering into the formation of the thickets in which one now and then finds himself entangled as he roams about the key, none are cultivated, not even the orange or lemon. The palmetto, likewise introduced by the English government, now grows wild, and is used by the negroes and poorer whites for thatching their houses.

The only plant that is really cultivated, except the pineapple, is the sweet-potato and the allied yam; the potato is, in fact, the staple article of diet among the blacks and a large proportion of the whites. As the only food-animal kept on the island is the hog, of a very poor breed and in still poorer condition, fresh meat is practically unknown, while canned meat is too dear to obtain, except as a rare luxury. Fish may be caught in abundance in the open ocean a mile or two away; but this implies the possession of a boat—which all have not got—and the expenditure of a little energy, which requires more than an

ordinary stimulus, as one learns, in a tropical climate. Stoves are almost unknown; and it was with the greatest difficulty that we could secure one at an exorbitant figure. Cooking is performed in the most primitive fashion, mostly out of doors. But few fowls are kept, and fresh milk is, of course, unknown; so that milk, eggs, and meat must be practically excluded from the dietary. Nor is fruit partaken of so abundantly as might be supposed; it is reserved to sell to the sailors who visit the island during the summer months. The pilot who came aboard to take our vessel over the reef had with him an unsightly lump of what he called bread, which, however, consisted really of a heavy mass of crushed sweet-potatoes baked into a sort of cake. Indian meal seems to be largely used also, though corn is not grown.

As in other ill-fed communities, meals are very irregular. We learned on one occasion that our diver, who had been at work up till 11 A.M., had not yet partaken of any breakfast, such fasting being, he said, a frequent occurrence. On another occasion, when bringing up some corals for us, he seized the opportunity of placing half a dozen big molluscs (*Strombus gigas*) in the bow of the boat,—"for my breakfast to-morrow." These were to be chopped up and stewed with onions, etc. By the side of many a house might be seen piles of the shells of these molluscs, left to be burned for lime, furnishing that of the very whitest and best, as might be expected. Enough will have been said to show that, from a physiological stand-point, this community is in a state of partial starvation.

Though it may surprise many to learn of it, a similar condition of things constantly exists, to my certain knowledge, at a fishing station on the coast of North Carolina; nor is it probably confined to that one locality. And the opportunity of comparing these two communities, similar in many respects, each being composed of Blacks and Whites, has been most instructive, and affords a firmer basis for the conclusions to be drawn in this paper.

When one examines the housing and general hygienic condition of the people, especially of the Blacks, a state not much more satisfactory is found. The Negro families are large; the rooms in the houses few and small; bedding insufficient; and huddling the consequence. Moreover, the natives, both white and black, have a peculiar custom of closing up the doors and windows, owing, I fancy, to dread of the violent storms, which

often come up suddenly in the night, and may, in fact, work havoc in an ill-built hut before the openings can be closed. Nevertheless, it follows that the inmates must be breathing a most impure air. One might expect that, with such an equable temperature and generally favorable climate, consumption would be unknown; but I found this was by no means the case, though it is much more common among the Blacks. This is to be explained by the racial tendency of Negroes towards phthisis; and by the fact that their condition of partial starvation is exaggerated by the unhygienic surroundings of their lives, particularly the impure air they breathe for half the time.

These facts are especially instructive, and strongly impress a medical observer. The natives themselves trace consumption to "licks," meaning blows and general ill usage. Such must not be left out of the reckoning; but in this case it cannot be set down to the excessive use of alcohol, for this is, fortunately, a very rare thing in this community. This brutality among a proportion of the Negroes is really traceable to an inborn savagery that neither church nor school nor public opinion—which latter I found very weak, however, in its condemnation—has yet been able to control. It is scarcely necessary to remark that such a state of things is not confined to this community; and I only notice it as an explanation of the existence of phthisis as given by the people themselves.

But it is gratifying to add that filthiness is not associated with the rest that hygiene must condemn. The houses of the Whites are mostly whitewashed or painted white, and personal cleanliness among all classes of the people is so open to observation that the most decided impression left on the visitor is that squalor is not in this instance associated with poverty. Nor can the inhabitants of this island be considered grossly ignorant or illiterate. True, many of the older people, born in slavery, cannot read, but this does not apply to the present generation. There is a fairly good school on the island, at which both the black and the white children assemble; and a noticeable absence of artificial or supercilious distinctions prevails. There are two churches, of different denominations, sustained partially by missionary effort. Their services, both on Sundays and week-days, are well attended by the people of both races, and drunkenness and profanity may be said to be almost unknown among them.

There appears to be little social life among the people, each family living very much apart, and the church being the one common meeting-place. A lack of knowledge of and interest in the affairs of the outer world was evidenced continually. A few of the boys growing up would like to go off "to see America," that unknown land from which come the ships,—their chief source of interest and profit; but the mass of the people seems never to dream of emigration any more than if they were rooted in the rocky soil,—a condition very puzzling to the visitor at first, but plain enough on later study. The announcement that a "Yankee" (vessel) is visible on the horizon never fails to rouse the entire community. The reason is complex. First of all, the old wrecking spirit only slumbers, and is not dead. The community is ever ready for "something to turn up;" if a wreck, well; if a vessel to take a cargo of pineapples, still well; for will not the sailors want some fruit, which the poorer residents have to sell, if not to eat,—and some shells or corals? And what child has not some of these? Possibly some service to be paid for at an extravagant rate; not to mention that if the ships come not the inhabitants find their occupation gone. Everything depends on the ripening of the pineapple, which is practically certain; and the exportation of it at a fair figure, which is by no means certain; and as the prices given by the shippers for this fruit annually tend to lessen, the people are becoming poorer rather than richer. However, it has never been my lot to see poverty so disguised as on this island; the entire village presents a picturesque, neat appearance; there is no squalor whatever; cleanliness, as before stated, is a most striking feature among all classes of the community; the clothing worn is adequate for this climate, and the people appear on Sundays decently clad; yet I have not the slightest hesitation in saying that the great majority, if not all of them, have not enough to eat, in the physiological sense of not being provided with food in such quantity and of such quality as will supply the losses of the body from tissue-waste.

Further, I think this community, and especially the white portion of it, affords the clearest evidence of psychical starvation; that is to say, of lack of mental and moral stimuli. This, however, will be clearer after an examination of the climatic conditions under which they live. I had not myself been many

days in this region before certain experiences of my own and of others of our party drew my attention to the influence of climate; and I endeavored, then and since, to study the subject closely, and to get its bearings, not only on the physical but on the psychical life of human beings.

The very fact that coral animals flourish only in waters comparatively shallow, and with a temperature not falling below about 66°–68° F., suffices to demonstrate in itself how high the average and the minimum must be in the Bahamas; while records kept throughout the year show that, as a matter of fact, the temperature never does fall below the above-noted point.

It was amusing to notice the astonishment of some of the children on seeing ice, which we had brought. One of the boys, on having a small piece placed in his hand, dropped it instantly, saying that "it burned;" while nothing could induce him to put any into his mouth. The following tabular statement of the temperatures for the month of June, as taken by myself, from the 9th to the 18th, at the hours indicated, will prove instructive:

At 7 A.M.	79°,	80°,	80°,	81°,	79°,	80°,	80°,	81°,	81°, 80°.
At 1 P.M.	83°,	83°,	84°,	—	82°,	84°,	84°,	83°,	85°, 85°.
At 7 P.M.	80°,	81°,	—	—	—	—	80.5°,	81°,	82°, —
At 10 P.M.	79°,	79°,	79°,	—	—	—	81°,	80.5°,	81°, 82°.

It will be noticed that the minimum was 79°, the maximum 85°; that the variations at a certain hour for each day were very slight; that the maximum variation during the twenty-four hours was small,—in a word, that the temperature for the hour and the day and the month approximated. This, taken with the observation that there is but little variation for each month of the year, establishes the fact that we have, in the climate of the Bahamas, one substantially without change of seasons, and with a *uniformly constant high temperature*. This condition in the environment has probably more to do with explaining the facts as one finds them in this community than any other; and after noting these, and the effect of the same conditions on himself and others of the party, the writer is prepared to believe that, in spite of racial superiority, the highest results, as evidenced in the character and achievements, cannot be attained by the Anglo-Saxon in a tropical climate. This conclusion may

not be in itself entirely novel; but the writer hopes to call attention to it in a new way, and, possibly, to place it on a foundation somewhat more scientific than that on which it has hitherto rested.

A broad fact that strikes a student of the condition of things on Green Turtle Key is that the Blacks deviate much less in condition and character from what they are elsewhere than the Whites. Excepting a few of the latter, who retain the English look of vigor, most of them have the stamp of weakness and anæmia in the plainest way impressed on them; they suggest feeble plants that have had insufficient light. The Blacks are not equal to the same race in the Northern States, perhaps, but are scarcely inferior to Negroes as found in some communities in the South.

It now remains to inquire what are the causes which have led to the degeneration of this English race. First of all must be named insufficient food, in the physiological sense, combined with impure air, from the custom of closing up the houses so thoroughly at night. The influence of such factors may also be well seen in the Indians of the Canadian Northwest living on the reserves. In consequence of the same sort of partial starvation, imperfect housing, and special forms of disease traceable to the advent of the white man with his peculiar vices, these Indians are fairly melting away off the face of the earth; consumption is especially destructive.

The women of all ages on Green Turtle Key have a very weakly, and generally unhappy, look; they show the influence of surroundings more than the men, as is nearly always the case.

Now, in a tropical climate, the lungs, the kidneys, and the skin,—three of the great excretors of the waste products of the bodily activities,—work under favorable conditions; there are not the climatic vicissitudes of northern latitudes to induce sudden congestions, or to throw very unequal work on different organs; but against this must be set the relaxing effect of the climate on the alimentary canal especially; hence on this island, as in other tropical lands, the tendency to actual disease is most manifest in this part of the body; but the amount really present here I could distinctly trace to other conditions, especially the quality of the food and the lack of variety in the dietary. But even when no actual disease is present, the decided lack of vigor referred to above is to be accounted for. No explanation of the

physical condition in which the nervous system does not play a large part can be at all complete; and the higher in the scale the race of men concerned, the more this must be taken into account. The bracing influence of a climate with moderate variations of temperature has its explanation largely through the nervous system. The fact that a cold bath raises the temperature cannot be wholly explained without bringing the nervous heat-producing mechanism into the reckoning.

Now, that the nervous system of the white man must be almost constantly depressed in this community may be made evident.

When it is borne in mind that the stimuli from the arrival of ships act only during the season of fruit-ripening, and that there are "hurricane months," during which no ships dare venture across the reef, it will be plain that for the greater part of the year this little community must be in a state of mental stagnation.

To the intelligent visitor, the objects here, totally unlike those he is accustomed to in his own land, have an intense interest. But all these are, to the man or the woman who has been looking on them for a lifetime, a very old story; water and sand and white rocks, and low, thick vegetation, make a wretchedly narrow environment after all, for a lifetime. What any brain becomes depends upon its capacity to develop; which is equivalent to saying that the cortical brain-cells concerned in the highest mental processes depend for their final best development very largely on the variety and number of (afferent) nervous impulses reaching them; that is to say, again, upon the richness of the individual's experiences; so that it seems to me absolutely impossible that the highest development could be attained in such a narrow life-prison as this really is to the constant resident.

It tells more on the white than on the black man because the brain of the former is superior to that of the latter; and conversely, the very difference here to be seen shows plainly that there is a pronounced inequality in favor of the white man's brain; for the circumstances under which they live are, at least, no worse in themselves, but rather better, in the case of the white man. The latter requires, for his best development, a richer experience than the Black.

Another very pronounced feature in the character of the people is their disinclination to steady, honest work; they are ready to speculate; they are prepared for wrecks; in fact, one finds the

gambling spirit well developed. It has, indeed, its actual manifestation as such, for groups of men may be seen any evening gaming by the hour for pennies,—exactly what one might expect as the outcome of such surroundings. But the climate alone tells in the plainest way as a depressing, energy-robbing factor. Hence the people will do without fish rather than expend the necessary energy to secure the much-needed nitrogenous food. A diet largely starchy will never produce the highest things, physical or other, in any race of men.

The lack of symmetry in the men, and much more so in the women, and an equal lack of comeliness of feature and beauty of expression, call for explanation.

It is to be borne in mind that, while there have been some emigrants, there have been but few immigrants; for thirty or forty years the community has been a stable one. Among a white population that does not travel, that does not receive accessions, and numbering only about three hundred, the play of "sexual selection" must be of the most restricted kind, and with corresponding results. But this does not furnish the entire explanation, I am quite sure. Long ago, Dr. O. W. Holmes, in his own inimitable manner, struck the key-note of the solution, in that remarkable book, "Elsie Venner." "Human beauty is an agricultural product in the country, growing up in men and women, as in corn and cattle, where the soil is good. Both in city and country, the evolution of the physical harmonies which make music to our eyes require a combination of favorable circumstances, of which alternations of unburdened tranquillity with intervals of varied excitement of mind and body, are among the most important. Where sufficient excitement is wanting, as often happens in the country, the features, however rich in red and white, get heavy, and the movements sluggish."

It may be said that for that play of the physical harmonies which constitutes good health a certain amount of variety and excitement, at all events in the Anglo-Saxon and some other races, is absolutely demanded. However much of a cage or prison such an island may be for men, it is incomparably more so for women; with them the variations, the stimuli, are reduced to a sad minimum; and so the flower fadeth.

The causes of the physical and psychical degeneracy to be observed on Green Turtle Key, in the Bahama Islands, may be

thus summarized: *An inadequate diet, in the physiological sense, combined with impure air; the depressing effect, physical and psychical, of a uniformly high temperature; the influence of uncertainty in the reward of exertion, and of unfounded expectation, begetting the gambling spirit; the limited play of sexual selection; and the lack of variety in the afferent influences reaching the nervous centres (experience),—all of which can be studied especially well in this community, on account of its diversity in race composition and its comparatively isolated and stable condition.*

HORNLESS RUMINANTS.

BY R. C. AULD, F.Z.S.

(Continued from page 746.)

THE genus *Bos* is composed of a large number of animals which fall into well-defined *bubaline*, *bisontine*, and *bovine*[1] divisions. The buffaloes and bisons have to be passed over, leaving the bovines to be solely dealt with as the most typical representatives.

Bovines are divided into (1) the hump-backed, Asian or Indian, and (2) the level-backed, European or Caucasian. The former, *Bos indicus*, inhabit the more tropical regions, and are subdivided into *large* and *small* varieties, best known under the name of zebus. The latter, *Bos taurus*, inhabit the more temperate regions, and are subdivided (primarily) into *B. primigenius*, or *urus*, and *B. longifrons*, or small Celtic short-horn. These may be regarded as corresponding, as to size, respectively with the two zebu types.

The seat of the origin of the ox has been generally assigned to a part of Asia not very remote from Europe, and by a few the zebu has been regarded as the parent stock from which many or all European varieties have been derived. Andrew Murray ("Geog. Dist. of Mammals," p. 142) takes this view. He says there is no osteological difference, and steps of transition can be traced through all other breeds, the Italian being somewhat similar in color to the zebu type, and having a thickening of the shoulders indicative of a hump. Rütimeyer also seems to think that the zebu is the progenitor of the small *B. longifrons*. Darwin—and with him the majority of naturalists—regards the zebu as a spe-

[1] This word is here used in its restricted sense.

cifically distinct type. Vasey,[1] on comparing the skeletons of the zebu and common ox in the museum of the Royal College of Surgeons, London, found there was a "material" anatomical difference; the former had four sacral and eighteen caudal, the latter five sacral and twenty-one caudal, vertebræ.

"The question of polled cattle is an exceedingly difficult one," truly writes Professor Boyd-Dawkins.[2] Professor Dawkins is the first—indeed, only—distinguished scientist who has seen in this question one of scientific importance. Others have treated it in the most casual manner.

This "difficult question" is a new one, and, however treated, the style of that treatment must be somewhat original. I have, therefore, aimed simply to deal with the copious testimony in the most systematic manner, and with such sufficiency of completeness as will properly exhibit its scientific interest, importance, and value.

Zebus.—In its native habitat the zebu occurs in many different varieties and conditions. Variations principally relate to size, number of humps, color of hair, and length or absence of horns. The horns are, as a rule, particularly small ("short, stubby"), and very often wanting. A peculiar tame or domesticated race occurs in Thibet. The color varies from red to black. Many of these are without horns, the opinion of them held by the natives being that they are "degenerated,"—strangely, the same view which some old French writers took of the Scottish polled cattle. To recompense the want of horns they have a prominent frontal protuberance, "so that it is with great difficulty they can be knocked down and killed." In the foreheads of our modern polled cattle a distinct indication of a similar growth occurs. The large zebus are red and brown in color; the middle-sized are white, blue-gray, brown, and even black. The small zebus are ashy gray in the main; they are paler on inferior portions of the body; they have the usual lop-ear character, with small or *no* horns. The lop-ear is a decidedly "hummel" characteristic. The "drooping ear" among our polls, too, is sometimes distinguishable, as is also the occurrence of the loose, abortive horns attached to the skin, and pendulous. Such horns are to be met

[1] Delineations of the Ox Tribe.

[2] Letter dated "*Woodhurst, Fallowfield, Manchester*, May 12, 1886."

with among all cattle. These smaller zebus are the most familiar to observing visitors to India; they are very tractable, and are used in carriages, like the ancient polled cattle of Scythia.

I met, in 1883, a native Indian gentleman, Mr. Hassain, and I put the question, "Is there any distinct polled breed in India, regarded as such?" He said there was, in the Northwest Province; their name is "*bagoudha*;" they are of a dull white color, used for heavy traffic. He said, in reply to my query, that no particular or special care was taken so as to breed them polled; they came so themselves. He stated, however, that there was a slight horny base sometimes to be observed on the frontals of some. Other "Indians" have informed me that these polled cattle are common in the teams to be seen so numerously in Bombay and other towns. I recollect a few cattle, from the Polders of the north, that were exhibited at Paris (1878), which, except for the want of the hump and lop-ear, would otherwise be described as similar to these polled zebus found in India and Persia, etc.

The figure given by Swainson (Fig. 5) to represent his *Bos pusio*, mentioned below, would illustrate Mr. Hassain's *bagoudha* exactly. It is the white, humped, lop-eared, strange-eyed, wrinkle-faced, hornless zebu complete.

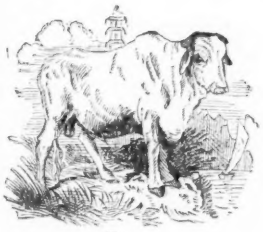


FIG. 5.

FIG. 6.—Indian Ox, or Zebu.

Jardine, who describes the zebus as occurring "either horned or without horns," figures, in the plate, in the "Naturalist's Library," vol. xii., an ashy gray zebu of the typical hornless race (Fig. 6). Other illustrations in various works, drawn by the most celebrated artists, such as Landseer, Macwhirter, and others, have depicted the same hornless zebu race fairly numerously, remarkably correctly, and true to the polled type. In the illus-

tration, "An Eastern Threshing-Floor" (Fig. 7), in Canon Farrar's "Life of Christ," the polls of the animals could hardly be better represented, or more thoroughly *mooly* or *humle* in appearance, though it cannot be claimed that they are so.

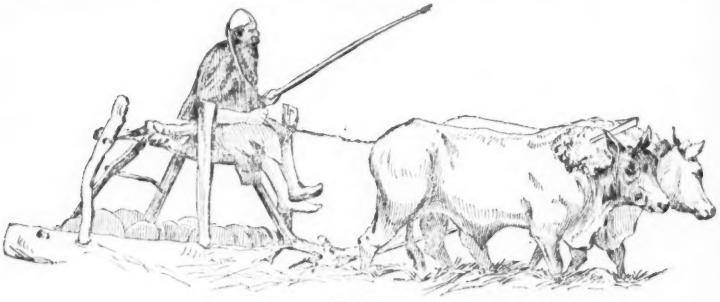


FIG. 7.

The late Professor Macgillivray, the distinguished naturalist of Aberdeen, in the *Journal of Natural History* (published at Edinburgh) for April, 1837, thus describes the zebus:

"Of the numberless varieties of the domestic ox, those peculiar to India and the east coast of Africa, formerly a race generally known by the name of zebu, or Indian ox, are among the most remarkable. They are more especially distinguished by having a large tumor or hump, chiefly composed of fat, on the back between the shoulders. Of this race there are numerous breeds, varying in size from that of our largest bulls to that of a mastiff, and disposed over Southern Asia, the islands of the Indian Archipelago, and the coast of Africa from Abyssinia to the Cape of Good Hope, in which countries it supplies the place of the common ox, being used as an article of food, as a lactiferous animal, and as a beast of burden. In some parts of India it is also employed for riding, as well as for drawing carriages, and is said to perform a journey of thirty miles a day. Its flesh, although good, is inferior to that of the European races, but the hump is reckoned a great delicacy. It varies in color like the other domesticated breeds, the most common tints being ash-gray, cream color, or white, but it is often red or brown, and occasionally black; some of the breeds are horned, others have pendulous or flexible horns destitute of the core or bony part, and some are entirely hornless."

Professor Macgillivray figures four races:

(1) The largest-horned race.

(2) The smaller-horned race.

(3) The smallest race.

(4) The hornless race.

W. Swainson, F.R.S., in his "Natural History of Quadrupeds," describes five types of Bovines:

"The *fourth* type appears likewise indigenous to the same continent (Asia), from whence, in fact, nearly all our domestic animals have originated. It is typically distinguished by its very diminutive size, by the almost total disappearance of the hump so highly developed in the East, and by having no horns (Fig. 5). The species is seldom seen in this country, nor do we know where a full account and figure of it is to be found; we have, however, seen it in Chinese paintings, and Major Smith assures us that an individual of the small zebu race is not larger than a hog! The name *Bos pusio* may therefore be correctly applied to this species."

To compare with the above, I quote his description of his *fifth* type:

"The first variety, the Galla ox, had horns which were extremely bulky and nearly four feet in length; in other words, nearly as long as the entire length of the *Bos pusio!* A second variety of this type was the Bornou race, of a white color, and with immense horns, which, instead of rising vertically, are couched outwards and downwards. The corneous external coat is very soft, distinctly fibrous, and at the base not much thicker than a human nail; the osseous core full of vascular grooves, and very cellular inside. The skin passes insensibly to the horny state, so that there is no exact demarcation where the one commences and the other ends."

Swainson's system of classification was peculiar. He endeavored to establish "circular" or "quinary" analogies throughout the animal kingdom. Here is his curious classification of "the genus *Bos*, the natural types":

		Analogies.	
1. *Bos scoticus*	Fierce, untamable.	Feræ.	Raptores.
2. *Bos taurus*	Pre-eminently typical.	Primates.	Insessores.
3. *Bos demaceros*	Appendages on the head greatly developed.	Ungulates.	Rasores.
4. *Bos pusio*	Stature remarkably small.	Glires.	Grallatores.
5. *Bos thersites*	Fore part of the shoulder elevated.	Cetacea.	Natatores.

Bos pusio he describes, we have seen, as hornless, and figures it so. His figure is "from a Chinese painting." Evidently so, but of which he gives no particulars.

Zebus in Other Regions.—John Lawrence (1805) says,—

"Upon the island of Madagascar, in Malabar and other parts of India, in part of Persia, in the Ukraine, Calmuck Tartary, Upper Ethiopia, and Abyssinia the bisons are of the proper, or large, species; in several of the last-mentioned countries their cattle are the largest in the world, attaining the height and size of camels. Irregular as to horns; *some entirely without*, others with the horns large, either branching or pendulous." Similar to what has been already described, and showing the wide dissemination of the zebu type.

Polled Breeds in Egypt.—The kinds of cattle in Egypt are sufficiently correctly noted by W. C. L. Martin:—[1]

"In ancient times this zebu race, as well as a race destitute of the zebu peculiarities, existed in Egypt. The figures of both are plainly delineated on ancient monuments and temples. An Egyptian painting in the British Museum represents two herds of oxen, of which the foremost in the upper compartment is distinguished by its hump and shorter horns (zebu) from the long-horned, straight-backed cattle (taurus) in the lower compartment. Perhaps, however, it was rather in Upper than in Lower Egypt that the zebu breed prevailed; such, at least, is the case at the present day. In Lower Egypt, as Burckhardt states, it is almost unknown; but it begins in Dongola, when all along the Nile as far as Sennaar no others are seen." Figs. 8 and 9 exhibit various horned races of the East and Egypt, to compare with the polled.

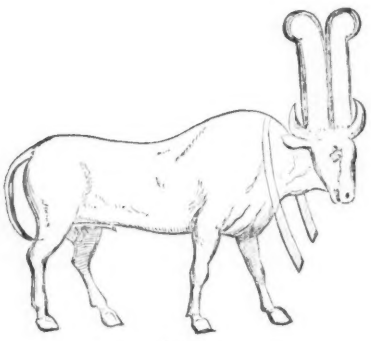


FIG. 8.

In speaking with officers and others who have been in Egypt, they state they have observed representations of polled cattle on the monuments, and also some among the present existing race. Dr. E. Lewis Sturtevant has also stated "hornless cattle, *Bos*

[1] Cattle, published 1852.

taurus, are figured in herds under the fourth dynasty,"—about 2700 B.C.

Figures of these polled cattle can be seen in most works treating of Egypt. The cut given by Professor Rawlinson in his "History of Egypt" represents three animals being physicked

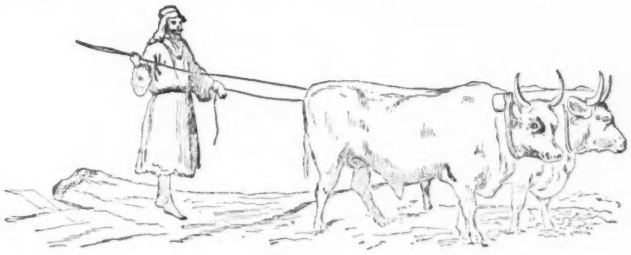


FIG. 9.

(the operator not in the safest of positions), of which two are polled. Another figure is given on page 172, "Rescuing Cattle from Inundation." Two of the six are polled. Wilkinson also figures them. In vol. ii. of his work, p. 76, in the figure, "A Bull-Fight," one is polled; p. 202, "An Ethiopian Princess driven by Oxen" (Fig. 10); pp. 447, 452, also bear figures in which polled cattle may be distinguished. In that splendid work, "Description de l'Égypte, ou recueil des observations et des recherches qui ont été faites en Égypte pendant l'Expédition de l'Armée française," 2d ed., 24 tom., Paris, 1821–29, there is a volume of plates, in which representations from the monuments are given. Reliefs of polled cattle in herds, etc., are also frequently figured. This work should be seen by every one interested in the subject of the antiquity of polled cattle. Ebers's work on Egypt, more easily accessible, might be consulted by the reader.

FIG. 10.

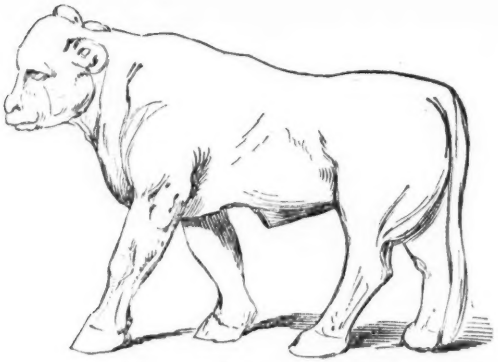


FIG. 11. (Figure in bronze.)

Rawlinson states that in Egypt "three distinct races of cattle were affected,—the long-horn, the short-horn, and the hornless." Birch ("Manners and Customs of Ancient Egyptians," by Sir J. Gardner Wilkinson, Bart.) says,—

"The cattle were of different kinds, of which three principal distinctions are most deserving of notice,—the short-horned, the long-horned cattle, and the Indian or humped ox; the last two, though no longer natives of Egypt, are common to this day in Abyssinia and Upper Ethiopia."

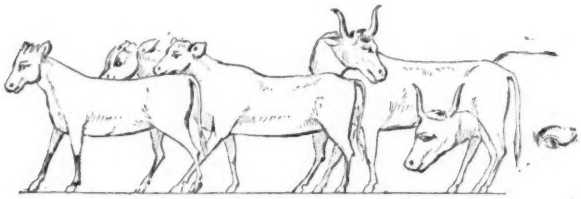


FIG. 12. (Egyptian monuments.)

In a foot-note to this he says, "A hornless variety was also known."

Cattle were domesticated in Egypt, according to Darwin, as early as 2000 B.C. Thus we have indication enough of the great antiquity of polled cattle. The Egyptians, it is supposed, were of Asiatic origin, and may have brought the progenitors of their

various breeds, including the carefully cultivated polled variety, with them.[1]

IN EUROPE.

Polled Cattle found in the Pliocene Deposits of Italy.—There is peculiar evidence of the existence of polled cattle in Europe during the Pliocene period. It was during the Upper Pliocene period that the genus *Bos* first appeared on the earth's surface. This was also the second stage in the development of deer, etc., —the period of hornless or feeble-horn rhinoceri, and of small-horned deer. Besides these, says Boyd-Dawkins, are some peculiar to Italy possessed of very remarkable characters. An ox, *Bos etruscus*, of Falconer, presents us with the first instance of polled cattle. And, on noting the "important characters of the fauna of the Pliocene period," he says,—

"It must also be remarked that the oxen (*B. etruscus*) were

[1] I may give a glimpse into the state of live-stock matters in Egypt, as may be gathered from the best sources. Dr. Samuel Birch, in his work already quoted, says beef and goose constituted the principal part of the ancient food throughout Egypt; and by a prudent foresight, in a country possessing neither extensive pasture lands nor great abundance of cattle, the cow was held sacred, and consequently forbidden to be eaten; and thus the risk of exhaustion, or at least greatly lessening their stock, was effectually prevented, and a constant supply maintained for the consumption of the people. That a considerable quantity of meat was served up at those feasts to which strangers were invited is evident from the sculptures. Plutarch says red oxen were lawful for sacrifice, but not so if they had a single white hair (compare Numbers: "Bring thee a red heifer without spot"). For the table the Egyptians killed cattle with black or red spots.

Agriculture held a high place in Egypt. As agriculturists they were adepts. They were wonderfully aided by the overflowing of fruitful Nile. The peasant ranked, however, above the *pastor*, or herdsman. The "herds," indeed, were an inferior class, and were, as individuals, looked down upon. The rich landed proprietors possessed large flocks and stocks of cattle, sheep, and goats, etc., on their estates. The denomination of pastor did not extend to the farmers who bred their own sheep or cattle; merely to those who herded them. The herds were looked over by the superiors of the estate; and they fully understood the different stages of grazing and stall-feeding. These stewards selected their shepherds, who held a responsible trust. Such as were skilled in cattle-management were chosen "to make them rulers over the cattle." Nothing was neglected. Branding was an annual operation. The royal cattle were branded or tattooed on their rumps with their regular numbers, as, "Palace, 86," etc.

In some parts the herds of cattle grazed on common pasturages, and were liable to be mixed. Hence this branding, which became imperative. It was, indeed, an annual "*rounding up*,"—which has thus a most respectable antiquity. Illustrations of all these operations are found on the monuments, which are a perfect pictorial record of these wondrous ancient times, handed down to us in an imperishable form.

sometimes devoid of horns, as may be seen in a specimen pointed out to me by Dr. Forsyth Major, in the Museum of Florence." And this is his comment: "It seems very likely that horns were originally a mere sexual character peculiar to the males, and transferred, like other sexual characters, ultimately to the females. This was brought about before the beginning of the Plistocene age, since all the oxen of that period possessed horns. If this view of the origin of horns be accepted, it is easy to explain the singular ease with which, in a comparatively short time, the horns have been bred off some of our domestic cattle by selection carried on through a few generations; and our polled cattle may be looked to as a reversion to an ancestral type. The small size also of the tusks of the domestic hog, compared with those of the wild boar, may be explained in the same manner."[1]

Falconer describes *B. etruscus* ("Pal. Mems., vol. ii. p. 481) as "so peculiar as to distinguish it very remarkably from *Bos primigenius* and *Bos priscus* (the bison). It is of much smaller size, and, I suspect, constitutes a distinct undescribed species, for whose designation *Bos etruscus* would appear appropriate."

Darwin, who only touches incidentally on the subject of hornless ruminants, makes reference to the skull of this hornless *Bos etruscus*, seeming to regard it as that of a female.

Figures of Polled Cattle on Greek and Roman Coins, B.C. 400.—The Greek and Roman (*fac-simile*) coins in the British Museum are arranged in such a manner as to afford a synoptical view, at once historical and geographical, of the gold and silver coinage of the ancient world, from the invention of the art of coining (about B.C. 700) down to the Christian era.

In the first compartment, relating to the First Period, circa B.C. 700–480, or the period of Archaic Art, ending with the Persian wars, in the third (geographical) section,—coins of Italy, Sicily, the southern shores of the Mediterranean, and Western Europe,—is No. 30, described thus in the catalogue:

"30. Messana ℞. [argentum]. *Obvs.* Head of lion, facing. *Rev.* MESSENION. Calf's head. Wt. 267.1 grs. After the taking of Miletus, B.C. 494, a band of Samians sailed to Sicily, and, under the advice of Anaxilaus of Rhegium, seized the city of Zancle. Anaxilaus soon afterwards sent a mixed colony to Zancle, and changed its name to Messana. The Samian types

[1] Early Man in Britain.

of this coin show that it dates from this period, circ. B.C. 490–480." The head of the so-called calf is distinctly *polled* (Fig. 13).

In the second compartment, relating to the Second Period, circa B.C. 480–400,—the period of Transitional and Early Fine Art to the end of the Athenian supremacy,—in the first (geographical) section, displaying the coins of Asia Minor, Phœnicia, Syria, etc., and Egypt, is No. 28 (Fig. 14), described in the catalogue thus:

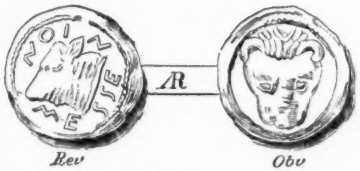


FIG. 13.

FIG. 14.

"28. Mytilene ℞. *Obvs.* Two calves' heads, face to face; between them a tree. *Rev.* Incuse square. Wt. 169 grs. This coin, in spite of its globular form, is not of archaic work; neither is the metal pure. It seems, therefore, to belong to the latter part of the fifth century." The heads are distinctly *polled* (Fig. 14).

In compartment seven, relating to the Seventh Period, circa B.C. 100–1,—the period of late Decline of Art, age of Mithradates the Great, and of Roman dominion, in the second (geographical) section, displaying coins of Northern and Central Greece, the Peloponnesus, and the islands of the Ægean, is No. 26, described in the catalogue:

"* 26. Roman ℳ. [aurum], aureus. *Obv.* CAESAR. Head of Augustus. *Rev.* AVGVSTVS. Bull. Wt. 123 grs. This coin may have been struck B.C. 27. Some of the coins here assigned to Greece may have been struck in Asia." The bull is a beautiful picture of a polled animal. The head could not be more distinct, or finer done (Fig. 15).

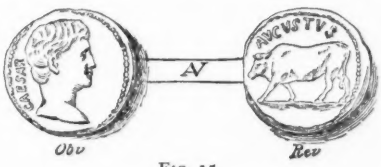


FIG. 15.

Any one who examines these *fac-simile* coins in the British Museum must be at once impressed, when cattle are represented,

with the remarkable distinctiveness given to the depiction of the horns where these had to be represented. (Figs. 16, 17, 18.)

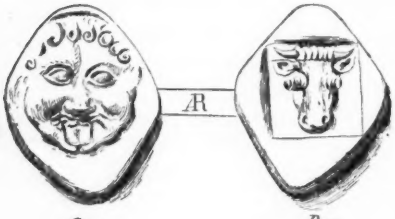


FIG. 16.

FIG. 17.

The horns are so distinct and perfectly done that any instance where they are absent is all the more valuable. All the heads I have picked out are decidedly hornless, and were thus assuredly meant by the original artist. The last coin, marked with an asterisk (*), is represented in the last autotype plate which illustrates the octavo edition of the catalogue, to be had at the Museum.

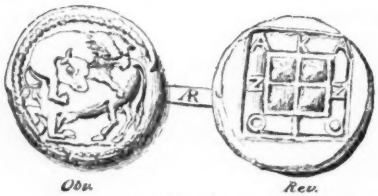


FIG. 18.

Mentioned by Herodotus, B.C. 400.—The father of profane history, in describing the cattle of the Arimaspi, a one-eyed race of men, who the Issedones themselves affirmed dwelt beyond them, towards the north of Scythia, says ("Melpomene," v. 28, 29) that "it was on account of the intolerable winter of eight months of this country that the race of cattle appear to be imperfect, and not to have horns; and the following verse from Homer, in his 'Odyssey' (B. iv. 1, 85), confirms my opinion as to the cause:

'And Libya, where the lambs soon put forth their horns,'[1]

rightly observing that in warm climates horns shoot out quickly, but in very severe cold the cattle either do not produce them at

[1] Cowper's translation:

. . . "the coasts
Of Libya, where the lambs their foreheads show
At once their horns—defended soon as yeaned."

all, or, if they do produce them, they do so with difficulty. Here, then, such are the effects of cold." Beloe, too, has this note: "Hippocrates, speaking of the Scythian chariots, says they are drawn by oxen which have no horns; that the cold prevents them having any." Strabo also mentions these ancient polled cattle.

Herodotus's opinion as to the cause of hornlessness has been accepted by many writers down to modern times. At first sight it seems true enough, that in the northern European regions we have polled or defectively-horned animals, while in the south we see immense-horned races; but exceptions are prominent: in the palmated horns of the female reindeer of Arctic regions,—a sex in deer that is always hornless in all other climes; in the polled cattle of Southern Europe; and in the no-horn or small-horned zebu of India.

If, as is believed, the Scythians, like the Egyptians, were of Asiatic descent, this fact has its significance.

In Poland.—It would appear that it is Oliver Goldsmith, in his "Animated Nature," whom subsequent English writers, such as Lawrence, 1805, follow in the statement that "the large polled breed of England was probably derived from Poland." The word "large" used by Goldsmith is valuable evidence in connection with the idea held in some quarters, that all polled cattle occur among the small cattle. It is in the Forest of Bialowiza, in Poland, that, under the special protection of the Czar, the wild "European bison" (*Bos priscus*) is preserved. This is the Aurochs or Ure ox of the Germans, and the Urus of Cæsar. Professor Low ("Domestic Animals of Great Britain") refers to a description of an ancient writer, who speaks of these Uri of the woods of Poland as black, with a white ridge along the chine.

Mentioned by Tacitus and others.—Major Hamilton-Smith, in Griffith's elaborate edition of Baron Cuvier's "Animal Kingdom," has this passage:

"Breeds with small and middle-sized horns exist in the Crimea, in a great part of Germany, Sweden, France, England, Scotland, Italy, Spain; and the hornless cattle—originally, as it would appear, a German breed, 'ne armentis quidem aut gloria frontis,' according to Tacitus—have spread to Iceland and Norway, where they are fed on dried fish. They are now abundant in Scotland,

exist in France, and about Penaranda, in Spain, from which they may have been transported to form the polled breed of Assumption, in Paraguay. They also are common in Madagascar and Abyssinia."

Froude, the historian, in his essay on Martin Luther, 1883, in relating the memorable appearance of the reformer at the Diet of Worms, where "he gave his answers" first in Latin and then in German, Eck requiring of him a plain answer, "yes or no without horns." The taunt roused him, and he replied, "I will give you an answer which has neither horns nor teeth." This passage may be taken as evidence of the knowledge or presence of polled animals in Germany in those times.

The polled cattle of Germany are extinct. H. von Nathusius, in reply to my inquiry, says,—

"We have no polled cattle in Germany, but I remember them in Norway, and I think they are found also in the Russian provinces bordering the Genesa Sea."

Victor Hehn, in a lately published work of great erudition,[1] heads his chapter on "cattle," "The Buffalo,"—certainly a rather antiquated view, which might be excused in such a writer as Headley, mentioned later, but hardly in Hehn. He also notes the disappearance of the German polled cattle:

"The *Bos* family was the first friend of man when emerging out of barbarism, and found its modifications through the migration of nations. . . . The wholly nomadic tribes brought new races of cattle with them into the districts in which they settled. . . . The three races of the South Russian steppes—a classical cattle region—are the deposits left by as many nomadic invasions. . . . The second South Russian species, small and red, are descendants of the old Scythian breed, of which Herodotus says that they were 'stumpy-horned,' and Hippocrates that they were 'hornless,' therefore resembling the small German cattle, of which Tacitus writes that they lacked 'the glory of the brow.' . . . The hornless cattle have now entirely disappeared in Germany, but they are still to be met with in Scandinavia, whence, during the middle ages, they spread to the White Sea."

In Austria.—In Austria there is a well-known breed of red polled cattle. It has been known from time immemorial, and has been preserved by Prince Lichtenstein on his estates. Some

[1] The Wanderings of Plants and Animals from their First Home.

of the Norfolk and Suffolk breed—also red and polled—have been taken thence to infuse new blood. Some of the Austrian agricultural journals have also advocated for this purpose the introduction of the Aberdeen-Angus, which came so prominently before their notice at the Paris International Exhibition in 1878. These red polled cattle of Austria are very interesting, and we are able to produce, from the most direct source, some information about them of the greatest interest.

We are indebted to the exertions of the Chevalier Walcher de Moltheim, ministerial counsellor, director of Prince Lichtenstein's estates. In a letter dated Vienna, I Bank Street, 9, February 5, 1886, he says,—

"I send you herewith enclosed the letter I wrote you some time ago, but which I did not mail because the answers I received appeared to me to be unsatisfactory and in many points obscure. I have caused later and more comprehensive inquiries to be made; but the result of the same was also unsatisfactory, as I did not learn anything further than I had already said in my letter,"—which is as follows (translation):

"The reports I could obtain about hornless cattle in Austria were delayed, and are now as follows:

"At the manor of Radim, in Bohemia, which belongs to his Highness the Prince of Lichtenstein, hornless cattle were produced in the year 1840, through the removal (to Radim) of the regular Bern breed, of red color, from the manors which the prince owns in Moravia; and it is proved that this new breed derives its origin from his own breed of hornless cattle. This breed was then continued at the manor of Radim with great care, and indeed with good success, up to the year 1878, when the whole stock of hornless cattle had to be killed on account of a pulmonary disease. The production of hornless cattle showed a great constancy in this respect, that, even in those cases where, on account of the lack of hornless bulls, horned bulls were employed, hornless calves were still the result.

"In the course of years his own breed had, by great carefulness, reached a high degree of improvement.

"In the year 1868 three cows and one bull of English breed were bought for the stall at Radim; but I have not been informed to which British breed these unhorned animals belonged. But these cattle also were affected by the pulmonary trouble.

"In the year 1868, before the purchase of the English animals, the stock of hornless cattle at the domain of Radim was as follows: six bulls, twenty-six cows, and two calves.

"Most of these cattle were of red or brownish-red color; one

single calf was black, sired by a Dutch bull upon an unhorned Bern cow.

"The weight of the three-year-old cows was eight hundred Vienna pounds, and thence in rising proportion to the ten-year-old cows, which were from one thousand to one thousand and forty Vienna pounds; bulls, nine hundred to thirteen hundred and twenty pounds. They were kept for the purpose of milk production, which latter amounted, in 1868, to from one thousand and seventy to fourteen hundred and nineteen Vienna quarts per cow.

"As intimated before, this breed was extinguished in 1878 at the prince's domain. Through the admission of bulls from Radim, the miller Moravek, at Tecek, possesses at present still two head of unhorned cattle.

"These are the only facts I can give now in answer to your request. Touching the bodily peculiarities, I can only add that the hornless cattle of home production retain the color, build, and peculiarities of the breed.

"The head is long and narrow, loins strong, skin thin and elastic; hair soft, shining, and close; the bone structure fine, but strong; neck and shoulders strong and full. Though small of stature, the animals were of exceeding beauty."

In France.—Major Hamilton Smith has mentioned the existence of polled cattle in France; and it is stated that at Rambouillet in-and-in breeding was practised among the celebrated cattle of that place—a white, hornless breed—with great success, until they were carried off by the cattle-plague of 1815. I have seen it stated that there are still a remnant of this or some other polled race preserved at one of the French gardens.

In Holland and Bavaria.—It has been stated that the late Mr. Morison, of Bognie, Aberdeenshire, Scotland, brought a lot of very fine, large cows from Holland or Belgium. "These cows were much larger in size than the home polls, and they were splendid milkers. They were of all colors, and mostly polled, with the exception of a few, which had very short, thick horns. I had four of those animals in my possession for several years. Two of them were black, with white stripe on back;[1] one was brindled, and the fourth was white, with short horns. The last mentioned was the biggest in size, and the best milker of the lot, but in consequence of the color of her first calf being white she was sold."

[1] Compare with Professor Low's description of the Uri of Poland.

A settler near where I am located has stated to me that polled cattle existed in his native country (Bavaria). His grandfather and another bred them there. They were the only parties who had them in the neighborhood. It was, he said, the habit of renewing, or alternating, their stock of cattle every few years, and for that purpose his grandfather and his neighbor had resorted to a district "near Holland" for specimens of these polled cattle, which had some celebrity at that time. The name he gave them was *hornlose*,—simply the same as our *hornless*. It is interesting to note that it was the king of Bavaria who presented gold medals, through M. Dutrone, to exhibitors at the Highland Society of Scotland, 1856. The reverse of the one gained by the late Mr. McCombie of Tillyfour states it to have been for the "Propagation des *Races bovines désarmés*, à M. W. MacCombie de Tillyfour, Ecosse, Amélioration de la Race d'Aberdeen pour la laitiere," etc. The late Hugh Watson, Keillor, also was presented with one for his remarkable cow "Grannie," which raised twenty-five calves and died at the age of thirty-six years and a half,—the greatest age, I believe, recorded to which an animal of the bovine species ever attained.

In Switzerland.—Dr. Ferdinand Keller, in his "Lake-Dwellings of Switzerland," translated by J. E. Lee, 1878, among the remains identified at Lüscherz and Möringen, notes:

(1) *Bos brachyceros-longifrons*, or marsh-cow. Certain remains only lead us to conclude that they belong to the Peat cow.

To this race also probably belonged the half of the occiput of a hornless individual. The specimen indicates a very small animal, in which the occipital proportions are exceptionally high. Similar forms are said to be found in the Norwegian cattle.

(2) *Bos primigenius.* Remains of this great race seem to have been found very sparingly.

(3) *Bos frontosus.* Remains of this race are by far the most numerous, on the average; the race was smaller than our spotted cow, yet possessed its characters most completely. The bones of the extremities are smaller than those of the spotted cow are in general. *Frontosus* belongs more especially to civilization.

In Norway, etc.—They exist in the Scandinavian peninsula. According to Mr. Bert Pettersen, Norwegian consul at Dundee, polled cattle are very common in the southern parts of Norway, while in Tromsö, within the Arctic Circle, they also exist in con-

siderable numbers, as is affirmed by Mr. John Neish, Jr., of The Laws (Scotland), who was there in 1879.

In Iceland.—Uno Van Troil, M.D., in his "Letters on Iceland," 1772, says,—

"Next to fishing, the principal support of the Icelanders is the breeding of cattle. Their beeves are not large, but very fat and good. It has been reported by some, though without foundation, that there are none among them with horns; it is true, however, that they seldom have any. They keep their large cattle at home in the yards the greater part of the year, though some have places appropriated to them in the mountains, which they call *Gatr*, where they send their cattle during the summer till the hay-harvest is over. They have a herdsman to attend them, and two women to milk them and make butter and cheese. It is common to meet with oxen running wild about the mountains, which are, however, driven home in autumn, as every one knows his own by a particular mark upon them."

Sir George Stewart Mackenzie, Bart., in his "Travels in Iceland," in 1810, says,—

"The cattle, in point of size, are very like the largest of the Highland sorts, except in one respect,—that those of Iceland are seldom seen with horns. As in other countries, we meet with finer cattle on some farms than others; but from observation I could make, and information I could obtain, the Iceland farmers know nothing of the art of breeding stock. The bulls are, in general, ugly, and no use is made of them till they are five years old. In rearing a bull calf no more attention is paid to him than others. Taking all the circumstances of management together, I had some reason to be surprised to find the cattle, upon the whole, so handsome. The cows, in general, yield a considerable quantity of milk, many of them ten or twelve quarts per day, and some a good deal more. Milk is usually made into what is called *skeer*, which has been already mentioned."

(To be continued.)

HISTORY OF GARDEN VEGETABLES.

BY E. LEWIS STURTEVANT, A.M., M.D.[1]

(Continued from page 833.)

COSTMARY. *Balsamita vulgaris* Willd.

THIS plant, says Bryant,[2] was formerly cultivated in gardens for the purpose of mixing with salads, and it is a pity it is not continued, as from its sensible qualities it seems superior to many aromatic plants now in credit. In England, then, it had gone out of culture in 1783. In France, however, its leaves are quite frequently used as a condiment.[3] It is a plant of very minor importance even in France. It occurs also in the gardens of Constantinople.[4] In the United States it is recorded by Burr[5] in 1863, who mentions one variety. The name alecost came from its former use in flavoring ales and beers.

Alecost, or Costmary, is called, in France, *baume-coq, coq des jardins, grand baume, herbe au coq, herbe de Sainte-Marie, menthe-coq, menthe à bouquets, menthe grecque, menthe Notre-Dame;* in Denmark, *balsam;*[3] in Germany, *die frauenmunze;* in Dutch, *tuinbalsam;* in Italy, *costo-ortense;* in Spain, *heirva de Santa;* in Portugal, *balsamita;* in Sweden, *svensk salvia;*[6] in Arabic, *belsanch, melsaneh;*[7] by the Greeks at Constantinople, *kosta.*[4] It is the *Mentha hortensis corymbifera* of Bauhin's "Pinax," 226.

CRESS. *Lepidium sativum* L.

De Candolle[8] inclines to believe this plant to be a native of Persia, whence it may have spread into the gardens of India, Syria, Greece, and Egypt, and even as far as Abyssinia. It is said by Xenophon, about 400 B.C., to have been eaten by the Persians before becoming acquainted with bread;[9] and Pliny, in the first century, speaks of the nasturtium as growing in Arabia, of a remarkable size. It finds frequent mention in the Greek

[1] Director of the New York Agricultural Experiment Station, Geneva.
[2] Bryant, Fl. Diet., 1783, 115.
[3] Vilmorin, Les Pl. Pot., 34.
[4] Forskal, Fl. Æg.-Arab., xxxii.
[5] Burr., Field and Gard. Veg., 416.
[6] McIntosh, Book of the Gard., ii. 237.
[7] Delile, Fl. Ægypt, illust.
[8] De Candolle, Orig. Des Pl. Cult., 69.
[9] Cicero, Tusc., 5, 34.

and Latin authors. It is named by Turner,[1] which indicates its presence in England in 1538, and in three of its varieties was in American gardens in 1806.[2]

Four varieties are now under culture,—the common, the curled and extra-curled, the broad-leaved, and the golden.[3]

The synonymy of these various types is as below, it being premised that the modern varieties vary somewhat in degree only:

I.

Nasturtium hortense. Fuch., 1542, 362; Trag., 1552, 82; Pin., 1561, 221; Ger., 1597, 194; Dod., 1616, 711.
Gartenkress. Roszlin, 1550, 188.
Nasturtium. Matth., 1558, 280; Lob. Obs., 1576, 107; Cam., Epit., 1586, 335; Matth., Op., 1598, 425; Chabr., 1677, 289.
Nasturtio. Pictorius ed. Macer, 1581, 75.
Nasturtium hortense commune. Bauh., Phytopin., 1596, 161.
Nasturtium hortense vulgatum. Bauh., Pin., 1623, 103.
Nasturtium vulgare. J. Bauh., 1651, ii. 912.
Common Garden Cress. Ray, 1686, 825; Vil., 1885, 207.
Garden Cress. Townsend, 1726.
Lepidium sativum. Lin., Sp., 1763, 899.
Common Cress. Stevenson, 1765; Bryant, 1783, 103; Miller's Dict., 1807.
Common Small-Leaved. Mawe, 1778.
Cresson alenois commun. Vil., 1883, 194.

II.

Nasturtium hortense crispum. Bauh., Phytopin., 1596, 161; Pin., 1623, 104.
Nasturtium hortense L. Ger., 1597, 194.
Nasturtium crispum latifolium. Matth., Op., 1598, 425.
Nasturtium crispum augustifolium. Matth., Op., 1598, 426.
Nasturtium crispum Joh. Bauhin. J. Bauh., 1651, ii. 913.
Nasturtium hortense crispum latifolium. Bauh., Prod., 1671, 44.
Nasturtium hortense crispum angustifolium. Bauh., Prod., 1671, 43.
Nasturtium crispum. Chabr., 1677, 289.
Curled Cress. Ray, 1686, 825; Townsend, 1726; Stevenson, 1765, 34; Bryant, 1783, 103; McMahon, 1806; Mill. Dict., 1807.
Lepidium sativum crispum. Lin., Sp., 1763, 899.
Cresson frise. L'Hort. Fran., 1824; Petit. Dict., 1826.
Cresson alenois frise. Vil., 1883, 195.
Curled, or *Normandy*, and *Extra-Curled Dwarf.* Vil., 1885, 207.

[1] Turner, Libellus, 1538.
[2] McMahon, Am. Gard. Kal., 1806.
[3] Vilmorin, The Veg. Gard., 1885, 207.

III.

Nasturtium. Cam., Epit., 1586, 335.
Nasturtium hortense latifolium. Bauh., Phytopin., 1596, 160; Pin., 1623, 103.
Nasturtium latifolium dioscorideum. J. Bauh., 1651, ii. 913.
Nasturtium latifolium. Chabr., 1677, 289.
Broad-Leaved Garden Cress. Ray, 1686, 825; Vil., 1885, 207.
Broad-Leaved. Townsend, 1726; Stevenson, 1765, 34; Mawe, 1778; McMahon, 1806; Mill. Dict., 1807.
Lepidium latifolium. Lin., Sp., 1763, 899.
Cresson à large feuilles. L'Hort. Fran., 1824; Petit, 1826.
Cresson alenois à large feuille. Vil., 1883, 195.

IV.

Cresson dore. Petit, 1826; Noisette, 1829.
Golden. Hort. Trans., 1826, vi. 583; Burr, 1863, 343; Vil., 1885, 208.
Cresson alenois dore. Vil., 1883, 195.

It appears as if the types of the modern varieties have not changed through culture, as three are quite ancient, and the fourth but an ordinary variation, or of a pale yellowish-green color. The curled cress seems to have been first observed by J. Bauhin, who furnished his brother, C. Bauhin, with seed preceding 1596.

The cress, gardyn cress,[1] or pepper-grass, is called, in France, *cresson alenois, passerage cultivée, nasitor;* in Germany, *gartenkresse;* in Flanders, *hofkers;* in Holland, *tuinkers;* in Denmark, *havekarse;* in Italy, *agretto, crescione inglese, cerconcello;* in Spain, *mastuerzo, malpica;* in Portugal, *mastruco;*[2] in Arabia, *half;*[3] in Arabic, *reshad;*[4] in Bengali, *aleverie, haleem;*[5] in Hindustani, *chunsee;*[6] in India, *halim,* or *chansur;*[7] in Persian, *turehtezuk;*[6] in Sindh, *ahreo;* in Telegu, *adala vitala.*[5]

Cuckoo-Flower. *Cardamine pratensis* L.

An insignificant and nearly worthless salad plant, native to the whole of Europe, Northern Asia, and Arctic America, extending to Vermont and Wisconsin. It has a piquant savor, and is used as water-cress. It is recorded as cultivated in the

[1] Turner's Libellus, 1538.
[2] Vilmorin, Les Pl. Pot., 194.
[3] Forskal, Fl. Ægypt-Arab., c. xvi.
[4] Delile, Fl. Æg., illust.
[5] Birdwood, Veg. Prod. of Bomb., 7.
[6] Ainslie, Mat. Med., i. 95.
[7] Speede, Ind. Handb. of Gard., 170.

vegetable-garden in France by Noisette[1] in 1829, and by Vilmorin[2] in 1883, yet, as Decaisne and Naudin[3] remark, but rarely. I find no record of its cultivation in England, but in America it is described by Burr[4] in four varieties, differing in the flowers, and as having become naturalized to a limited extent,—a fact which implies a certain cultivation. Its seed does not appear in our seed-catalogues.

The Cuckoo-Flower, or Lady's Smock, is called, in France, *cresson des pres, cresson elegant, cressonnette, passerage sauvage;* in Germany, *wiesen kresse;* in Spain, *berros de prado.*

Cucumber. *Cucumis sativus* L.

The cucumber, under the form *Cucumis hardwickii* Royle, is found growing wild in the Himalaya region, and a variety (*sikkimensis* Hook) is cultivated in Nepal and Sikkim.[5] Its origin is therefore ascribed to the East Indies. It has been a plant of cultivation from the most remote times, but De Candolle[6] finds no support for the common belief of its presence in ancient Egypt at the time of the Israelite migration into the wilderness, although its culture in Western Asia is indicated from philological data as more than three thousand years old. The cucumber is said to have been brought into China from the West 140–86 B.C.,[7] and can be identified in a Chinese work on agriculture of the fifth century, and is described by Chinese authors of 1590 and 1640.[8] Cucumbers were known to the ancient Greeks[9] and to the Romans, and Pliny[10] even mentions their forced culture. They find mention in the middle ages, and in the botanies from Ruellius (1536) onward. In America they are almost coeval with the discovery, as the companions of Columbus were growing them in their gardens at Hayti in 1494.[11] Their distribution was rapid. Cartier[12] found "very great cucumbers" in cultivation by the Indians near the present Montreal in 1535, and De Soto[13] found, in Florida, "cucumbers

[1] Noisette, Man., 1829, 356.
[2] Vilmorin, Les Pl. Pot., 1883, 198.
[3] Decaisne & Naudin, Man., iv., 228.
[4] Burr, Field and Gard. Veg., 1863, 344.
[5] Cogniaux, Cucurbitaceæ in De C. Monog., iii. 498.
[6] De Candolle, Orig. Des Pl. Cult., 212; Eng. trans., 266.
[7] Bretschneider, On the Study, etc., 15.
[8] Bretschneider, Bot. Sin., 78, 59, 83.
[9] Theophrastus, Bodæus a Stapel ed., 1644.
[10] Pliny, lib. xix. c. 23.
[11] Irving, Columbus, 1859, i. 380.
[12] Cartier, Pink. Voy., xii. 652.
[13] De Soto, Florida, 44.

better than those of Spain." In Virginia they were seen by Captains Amidos and Barlow in 1584,[1] and are mentioned again in 1609.[2] In Massachusetts they were under cultivation before 1629.[3] It is not, however, certain that these references all refer to the cucumber, but other references which might be given seem sufficient to establish the fact of its early distribution on the continent of America.

Vilmorin, in his "Les Plantes Potageres," 1883, describes thirty varieties. I have seen the most, if not all, of these growing, as well as others, in number, including synonymes, of fifty-nine different names. While some of the varieties grown are but little differing, yet there is a number of kinds which are extraordinarily distinct. In pursuing my plan of treating of the origin of the types of varieties I recognize the difficulty of a very complete treatment, through my little knowledge of the wild forms, and of the species from a botanist's point of view. The following attempt, however, may be considered reliable as far as it goes:

The types of our common cucumbers are fairly well figured in the ancient botanies, but the fruit is far inferior in appearance to those we grow to-day, being apparently more rugged and less symmetrical. The following synonymy is established from the figures and descriptions:

Cucumis sativus vulgaris. Fuch., 1542, 697.
Cucumis sativus. Roszlin, 1550, 116; Cam., Epit., 1586, 294.
Cucumis. Tragus, 1552, 831; Fischer, 1646.
Cucumis vulgaris. Ger., 1597, 762; Chabr., 1677, 134.
Concombre. Tourn., 1719, t. 32.
? Short Green. Park. Par., 1629.
? Short Green Prickly. Mawe, 1778; Miller, 1807.
Early Green Cluster. Miller, 1807.
Green Cluster. Thorb., 1828.
Early Cluster of American seedsmen.
Etc.

A second form, very near to the above, but longer, less rounding, and more prickly, has a synonymy as below:

Cucumeres. Matth., 1558, 262.
Cucumis sativus. Lugd., 1587, i. 620.

[1] Smith's Va., Pink. Voy., xiii. [2] A True Decl. of Va., 1610, 13.
[3] Higginson, Mass. Hist. Soc. Coll., 1st ser., i. 118; Wood, New Eng. Prosp., 1st ed., p. 11.

Cucumeres sativi and *esculenti.* Lob., Ic., 1591, i. 638.
Cucumis vulgaris. Dod., 1616, 662.
Cedruolo. Cast., Dur., 1617, 103.
Cucumis vulgaris, viridis, and *albis.* J. Bauh., 1651, ii. 246.
Long Green Prickly. Mill. Dict., 1807.
Early Frame. Thorb., Cat., 1828 and 1886.
Etc.

The third form is the smooth and medium-long cucumbers, which, while they have quite a diversity of size, yet have a common shape and smoothness. Such are:

? Cucumer sativus. Pin., 1561, 192.
Concombre. Tourn., 1719, t. 32.
? Large Smooth Green Roman. Mawe, 1778; Mill. Dict., 1807.
Long Smooth Green Turkey. Mawe, 1778; Mill. Dict., 1807.
Long Green Turkey. Thorburn's Cat., 1828.
Turkey Long Green, or *Long Green.* Landreth, 1885.
Greek, or *Athenian.* Vilmorin, 1885.
Etc.

The fourth form includes those known as English, and are distinct, from their excessive length, smoothness, and freedom from seeds, although in a botanical classification they would be united with the preceding (from which they have, doubtless, originated). They are usually quite free from spines, often smooth, and, as grown, are very straight. My synonymy for these would scarcely be justified had I not observed the tendency of the fruit to curve under conditions of ordinary culture:

Cucumis longus. Cam., Epit., 1586, 295.
Cucumis longus eidem. J. Bauh., 1651, ii. 248.
Green Turkey Cucumber. Bryant, 1783, 267.
Long Green English varieties. Vilm., 1883, 163.

The Bonneuil Large White Cucumber, grown largely about Paris for the use of perfumers, is quite distinct from all other varieties, the fruit being ovoid, perceptibly flattened from end to end in three or four places, thus producing an angular appearance. We may suspect that Gerarde figured this type in his Cucumber, which came from Spain into Germany, as his figure bears a striking resemblance in the form of the fruit and in the leaf:

Cucumis ex Hispanico semine natus. Ger., 1597, 764.
Cucumis sativus major. Bauh., Pin., 1623, 310 (excl. Fuch.).

Bonneuil Large White. Vilm., 1885, 222.
White Dutch. A. Blanc, No. 6133.

The other types of known cucumbers are those which have lately appeared under the name of Russian. I know nothing of their history. They are very distinct, and resemble a melon more than a cucumber,—at least in external appearance:

1. *The Early Russian*, small, oval, and smooth.
2. *The Russian Gherkin*, obovate, and ribbed like a melon.
3. *The Russian Netted*, oval, and densely covered with a fine net-work.

The appearance of these new types indicates that we have by no means exhausted the capabilities of this species. The *Turkie cucumber* of Gerarde is not now to be recognized under culture, nor are the *Cucumer minor pyriformis* of Gerarde and of J. Bauhin, the *Cucumis pyriformis* of C. Bauhin's "Phytopinax," 1596.

If the synonymy be closely examined it will be noted that some of the figures represent cucumbers as highly improved as at the present day. The *Cucumis longus* of J. Bauhin is figured as if equalling our longest and best English forms; the *concombre* of Tournefort is also a highly improved form, as is also the *cucumeres* of Matthiolus in 1558.

The cucumber is called, in France, *concombre*, *cocombre* (cocomber by Ruellius, 1536); in Germany, *gurke*, *kukummer;* in Flanders and Holland, *komkommer;* in Denmark, *agurken;* in Italy, *cetriolo*, *cedriuolo;* in Spain, *cohombro*, *pepino*; in Portugal, *pepino*.[1] It was called *cowcumber* by Ray in England in 1686. Called, in Greece, *aggouria;* in Slavonic, *krastavak;* in Esthanian, *ukkuritz*, *ug gurits* or *urits;*[2] in Polish, *ogorek;* in Bohemian, *agurka;*[3] in Tartar, *kiar;* in Calmuc, *chaja;* in Armenian, *karan;* in Russian, *ogurzi;*[4] in Egypt, *khyar*,[3] *fakus;*[5] in Arabic, *kusud;* in Bengali, *susha*,[5] *sasha*, *khyira*, *kankur;*[3] in Ceylon, *rata-kækeri*, *pipingya;* in Hindustani, *keera*,[5] *khira* or *kakri;* in Persian, *kyar;*[3] in Sanscrit, *sookasa;* in Tamil, *mooloovelleri;*[5] in Japan, *akwa*, *karas uri*, *ki uri*.[6]

The cultivated cucumber was the *sikus hemeros* of Dioscorides, the *sikuos* of Theophrastus.

The *Cucumis flexuosus* L. is occasionally sold by our seeds-

[1] Vilmorin, Les Pl. Pot., 1883, 159.
[2] De Candolle, Orig. Des Pl. Cult., 210.
[3] Pickering, Ch. Hist. of Pl., 640.
[4] McIntosh, Book of the Gard., ii. 668.
[5] Birdwood, Veg. Prod. of Bomb., 156, 301.
[6] Thunberg, Japan, 324.

men to be grown as a curiosity, but it may be used for pickling. This plant was known to the herbalists, and its figures compare with those of our modern seedsmen, as, for instance:

Cucumis longus. Lugd., 1587, i. 621.
Green Serpent. Dammon Cat., 1884–85.
Concombre Serpent. Vilmorin, 1883, 166.

The fruit is characterized by its striæ, which render it at once recognizable. In Japan it is called *sjo kwa, awo uri.*[1]

Cumin. *Cuminum cyminum* L.

A small annual plant indigenous to the upper regions of the Nile, but carried at an early period by cultivation to Arabia, India, and China, as well as to the countries bordering on the Mediterranean.[2] It is referred to by the prophet Isaiah,[3] and is mentioned in Matthew.[4] Pliny[5] calls it the best appetizer of all the condiments, says the Æthiopian and the African are of superior quality, but that some prefer the Egyptian. During the middle ages Cumin was one of the species in most common use, and is mentioned in Normandy in 716, in England between 1264 and 1400, and is enumerated in 1419 among the merchandise taxed in the city of London. It is mentioned in many of the herbals of the sixteenth and seventeenth centuries, and is recorded as under cultivation in England in 1594.[6] In India the seeds form an ingredient of some curry powders and pickles,[7] and in France yet find use in cookery.[8] The seed is occasionally advertised in American seed-catalogues,[9] but is probably very rarely grown.

Cumin is named, in France, *Cumin de Malte;* in Germany, *pfeffer-kummel;* in Holland, *komijn;* in Italy, *comino di Malta;* in Spain, *comino;*[8] in Greece, *kumino;* in Egypt, *kammoun;* in Egyptian, *thapen,* or *tapen,* or *tapn;*[10] in Arabic, *kimoon;* in Bengali, *jeera,* or *zira;* in Ceylon, *dooroo;* in Hindustani, *jeera, zira;* in Malay, *jintan;* in Sanscrit, *jeruka ajaji;* in Tamil, *siragum;* in Telegu, *gilakara.*[11]

[1] Kaempfer, Amœn., 1712, 811.
[2] Pharmacographia, 1879, 331.
[3] Isaiah, ch. xxviii. 25–27.
[4] Matthew, ch. xxiii. 23.
[5] Pliny, lib. xix. c. 47.
[6] Mill. Dict., 1807.
[7] Dutt., Hind. Mat. Med., 173.
[8] Vilmorin, Les Pl. Pot., 1883, 199.
[9] Vick's Cat., 1884.
[10] Pickering, Ch. Hist., 211.
[11] Birdwood, Veg. Prod. of Bomb., 40, 237.

DANDELION. *Taraxacum officinale* Weber; *T. dens leonis* Desf.

The dandelion is a modern introduction to our gardens, and all the varieties now grown can be recognized in a state of nature; and yet, on account of its popularity, and hence the forced conditions of its growth, the variations, to the careless observer, seem very great. The history of the improved dandelion may be found in full in the AMERICAN NATURALIST of January, 1886.

The beginnings of the culture of a plant must, however, be very gradual, single individuals often growing the species in gardens long before the plant receives general appreciation. Thus with the dandelion, although its culture cannot be fairly said to antedate 1836, yet Stevenson, in his "Garden Kalendar" for 1765, in England, although not directly mentioning its culture, yet implies culture by giving directions for the blanching. In China, according to Bretschneider,[1] the leaves are recorded as being eaten as a vegetable in the fourteenth century, and the plant is classed among vegetables by Li-shi-chen, a writer of the sixteenth century; but from the data given we cannot assume cultivation.

DILL. *Anethum graveolens* L.

This aromatic plant has but little use in the garden. In France the seeds are used as a condiment, and for pickling with cucumbers. In American gardens it is rather to be considered as a medicinal herb. It is commonly regarded as the *anethon* of Dioscorides and the *anethum* of Pliny, Palladius, and others. The name *dill* is found in writings of the middle ages, and it is spoken of as a garden plant in the early botanies. The variety *A. sowa* De C. is largely grown in India. In England it was called *dyll* by Turner[2] in 1538, which implies its presence at that date. It also occurs in the vocabulary of Alfric, Archbishop of Canterbury, in the tenth century.[3] It was in American gardens before 1806,[4] and seems to occur spontaneous in the far West, as its roots are used as a food by the Snake and Shoshone Indians, by whom it is called *yampeh*.[5]

[1] Bretschneider, Bot. Sin., 53, 59.
[2] Turner, Libellus, 1538.
[3] Pharmacographia, 1879, 328.
[4] McMahon, Am. Gard. Kal., 1806.
[5] Fremont's Expedition, 154; Dept. Ag. Rept., 1870, 405.

Dill, or dyll, is called, in France, *aneth, fenouil batard;* in Germany, *dill;* in Flanders, *dille;* in Denmark, *dild;* in Italy, *aneto;* in Spain, *eneldo;*[1] in Arabic, the plant *chebet*, the seed *chamar;*[2] in Egypt, *sjoebet;* in Yemen, *schibt;*[3] in Bengali, *suloopha, soolpha;* in Ceylon, *sattacooppa;* in Hindustani, *sowa, soie, soya, shutapoospha;*[4] in India, *shutapooshna;*[5] in Sanscrit, *sitasiva, missreya, shaleya;* in Tamil, *saddacooppie;* in Telugu, *suddapa, sompa-sopu.*[4]

Earth-Nut. *Lathyrus tuberosus* L.

A plant now included among vegetables for the garden by Vilmorin,[6] although he says it is scarcely ever cultivated, but the tubers are often collected from the wild plant in France. Burr[7] likewise includes this species among American garden plants, but we know not upon what authority. In 1783, Bryant[8] says this French weed was cultivated in Holland for its roots, which were carried to market; and De Candolle and Sprengel[9] say that in Siberia the tubers are much relished by the Tartars, and also are used in Germany. It scarcely can be considered seriously as a plant of culture.

The earth-nut, tuberous-rooted pea, or eatable-rooted pea,[7] is called, in France, *gesse tubereuse, anette, anotte de Bourgogne, chataigne de terre, chourles, favouette, gland de terre, macion, macusson, mitrouillet, souris de terre;* in Germany, *erdnuss;* in Flanders, *aardnoot;* in Holland, *aardakker;* in Italy, *ghianda di terra;*[6] by the Calmucks, *sohnok;*[10] by the Tartars, *tschina.*[9]

[1] Vilmorin, Les Pl. Pot., 8.
[2] Delile, Fl. Ægypt, illust.
[3] Pickering, Ch. Hist., 323.
[4] Birdwood, Veg. Prod. of Bomb., 38, 237.
[5] Speede, Ind. Handb. of Gard., 1842, 181.
[6] Vilmorin, Les Pl. Pot., 1883, 241.
[7] Burr, Field and Gard. Veg., 1863, 103.
[8] Bryant, Fl. Diet., 1783.
[9] De Candolle & Sprengel, Phil. of Pl., 410.
[10] Pickering, Ch. Hist., 670.

(To be continued.)

REMARKS ON CLASSIFICATION OF VERTEBRATA.[1]

BY BURT G. WILDER.

MANY classifications of animals present three general features:

(*a*) An approximate conformity to the prevailing idea that the kinds or grades of groups, the "categories" of the elder Agassiz, are limited to branch, class, order, family, genus, and species, with, in some cases, the recognition of intermediate grades,—*e.g.*, sub-class, superorder, etc.

(*b*) The division of a given group into an indefinite number of subdivisions, commonly more than two,—*e.g.*, of natural objects into three kingdoms; of animals into four, five, or seven branches; of vertebrates into five or more classes.

(*c*) The frequent discrimination of groups by characters which are neither constant nor peculiar, and derived from parts like the skeleton or limbs, which are easily preserved, examined, and described,—*e.g.*, Vertebrata, Chordata, Hyostylica.

The accompanying arrangement is partial, and in several respects provisional. It accords essentially with the more recent views of high authorities, but attention is called to the following features:

(*a*) It is wholly *dichotomous.*

(*b*) Several of the divisions are based upon the conditions of the *cavities* of the *central nervous system.*

(*c*) The new names refer to characters which are *constant* and *peculiar*, so that they are not merely designatory in a conventional sense, but *etymologically* and *descriptively correct.*[2]

(*d*) The names are largely *correlated* so as to suggest their antitheses.

The writer fully appreciates the undesirability of introducing new terms, and by no means urges the adoption of any here presented excepting as expressive and convenient substitutes for phrases.

[1] Read at the New York meeting of the American Association for the Advancement of Science, Aug. 12, 1887.

[2] On this point see the writer's "Educational Museums of Vertebrates," Amer. Assoc. Proc., 1885, p. 276.

SAUROPSIDA (= reptiles and birds); mesocœle laterally extended; roof bilobate.

MAMMALIA.—Mesocœle tubular; mesocœlian roof quadrilobate, forming two pair of optic lobes.

↘

AMNIOTA = Abranchiata = reptiles, birds, and mammals; aulic floor approximately vertical.

ANAMNIOTA = Branchiata = Amphibia + Dipnoi; aulic floor horizontal.

↘

MICRAULICA (*aula small;* cerebral hemispheres extended vertically); = Amphibia, Dipnoi, reptiles, birds, and mammals.

MEGAULICA (aula large; cerebral hemispheres extended horizontally or undifferentiated); = Ichthyopsida—Amphibia, Dipnoi, and Branchiostoma.

↘

MONOCŒLIA (encephalocœle single; neuron epaxal only; axon unsegmented); =Cephalochorda = Acrania = Leptocardia = Monolocularia = Branchiostoma.

POLYCŒLIA (*encephalocœle segmented;* neuron partly preaxal; axon vertebrated) = Craniata = Pachycardia = Multilocularia.

↘

PHENOCŒLIA (*neurocœle persistent*) = metamera = Branchiostoma and other vertebrates.

CRYPTOCŒLIA (neurocœle transitory) = Ametamera = Urochorda = tunicates.

↘

CŒLONEURA (neuron hollow) = Chordata (+ Enteropneusta ?).

STEREONEURA (nervous centre solid if present) = most "Invertebrates."

↘

METAZOA.

Explanation of the Table.—The more comprehensive groups are below and their divisions above.

From the point representing a given group two lines diverge, forming what may conveniently be called a *furca*, or two-tined fork.

The vertical tines form part of a line of direct ascent to man. The oblique tines or branches extend to the left, and indicate groups not in the line of succession.

For convenience the furcas may be numbered from below upward, and the groups mentioned as *direct* and *oblique*, like the tines which represent them.

The only unfamiliar terms which are not self-explanatory are *mesocœle*, the cavity of the mesencephal, or segment of the optic lobes, and *aula*, the mesal division of the prosocœle, or cavity of the prosencephal. *Preaxal* and *epaxal* are synonymes of *prechordal* and *epichordal*. *Monolocularia* and *multilocularia* refer to the cardiac cavities.

For the sake of brevity the arithmetical signs +, —, and = (plus, minus, and equal) are employed.

General Features of the Scheme. Dichotomy.—The twofold division of groups is not new in practice, and is, as it seems to the writer, becoming more common,—*e.g.*, the primary division of animals into Protozoa and Metazoa in place of four or more "branches"; the primary division of vertebrates into Acrania and Craniota, and the combination of Reptiles and Birds as Sauropsida. But, apparently, there has not been hitherto a distinct recognition of dichotomy as a fundamental principle in natural classification, or an expression of doubt as to whether any group really comprises three or more equal and co-ordinate subdivisions. The writer's view may be briefly stated as follows: *In any assemblage of three or more objects, individuals, or groups, two or more of these units are more nearly related to one another than to the third or the others, indicating a primary division of the entire assemblage.* Very commonly the basis for the distinction is the presence or absence of an organ, feature, or condition, whence arise positive and negative names, like *vertebrate* and *invertebrate*, *amniota* and *anamniota*, etc.

Irrespective of special facts, then, the writer has been led to doubt the naturalness of, for example, the popular subdivision of natural objects into three co-ordinate kingdoms, *animal*, *vegetable*, and *mineral;* of the chordata into *urochorda*, *cephalochorda*, and *vertebrates;* of vertebrates into *Ichthyopsida*, *Sauropsida*, and *Mammalia*, and of mammals into *Prototheria*, *Metatheria*, and *Eutheria*. Polychotomy is probably never more than provisional, and all classification will eventually be dichotomous.

The Morphological and Taxonomic Importance of the Central Nervous System.—The superior taxonomic value of the brain and heart was insisted upon by the writer in a paper read before this association in 1875; during the last seven years, as may be seen from various publications, he has become more and more impressed with the profound morphological significance of the presence and modifications of the *cavity* of the central nervous system, the *neurocœle*.

A neurocœle persists in all vertebrates, including Branchiostoma, and is present in the early stages of all Tunicates whose development is known. So far as the writer has been able to ascertain, the central nervous system is *neither tubular nor even grooved at any stage with any "Invertebrate,"* excepting the Tunicates, and, perhaps, *Balanoglossus*.

In accordance with the prevailing tendency to utilize the skeletal parts for taxonomic purposes, the vertebrates and Tunicates have been called *Chordata*, and *Balanoglossus* has been spoken of as a *Hemichordate*. Balfour regards the notochord as "the most characteristic organ of the Chordata."

In proposing to replace *Chordata* (a word, by the way, easily mistaken for the Latin *caudata*) by Cœloneura, the writer cares less for the adoption of the term than for the admission that soft parts are not only physiologically but morphologically more significant than hard; that the neuron is more important than the axon; and that *the cavity of the one is a more substantial basis for the primary subdivision of the Metazoa than is the entire mass of the other.*

Special Points and Queries.—Should it seem desirable to separate those Metazoa in which the nervous system is distinct from those in which none has been detected, it would only be necessary to interpolate between furcas one and two another, the two tines of which should stand respectively for *Neurica and Aneurica*, or equivalent terms; the Neurica would then comprise the Cœloneura and the Stereoneura.

The name *Vertebrata* is used only as a synonyme; if retained, there should be an understanding as to whether it shall exclude Branchiostoma, or include that form, or include the Tunicates as well.

Among the members of the oblique division of the fourth furca the Ganoids and Teleosts should be combined as fishes or Pisces, and distinguished from each other by the persistent and considerable cavities of the olfactory lobes with all Ganoids. Notwithstanding the writer's supposed observation (*Amer. Assoc. Proc.*, 1876, 258), these cavities are absent or insignificant in all Teleosts examined.

The association of the Amphibia with the Dipnoi is in accordance with the considerations presented in the writer's paper on the brain of *Neoceratodus;* see this journal, June, 1887, p. 544.

The characterization of the mesocœlian roof of the Sauropsida as *bilobate* may need qualification in view of Spitzka's observations on the interoptic lobes of some reptiles.

The primary division of the Mammals should, perhaps, be into the Eutheria and the others (implacentals). Something is to be said for either view, and it is to be hoped that the hearts

of typical implacentals, prepared by alinjection, may be carefully compared with each other and with those of representative Eutheria.

Historical Note.—It is proper to add that the idea of recognizing two antithetical groups according to the presence or absence of a neurocœle, was first formulated by the writer, under the names *cœlianata* and *acœlianata*, on a slip dated November 27, 1883; *cœloneura* and *sterconeura* are dated April 3, 1885. The passage on page 416 in Bell's "Comparative Anatomy and Physiology" (Philadelphia, 1885), commenting on the presence of a cavity in the nervous axis of chordata, was first seen March 13, 1886; but in January of that year, in lectures to students, and in a letter to Prof. J. H. Comstock, the general scheme of a dichotomous classification was presented in substantially the form here given.

SAND-BOULDERS IN THE DRIFT, OR SUBAQUEOUS ORIGIN OF THE DRIFT, IN CENTRAL MISSOURI.[1]

BY J. W. SPENCER, M.A., PH.D., F.G.S.

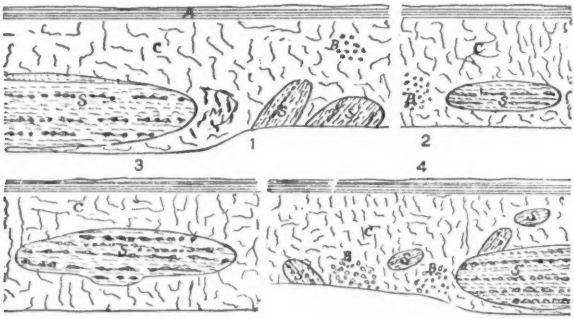
LOCATION.—During the winter of 1883–84 deep excavations were made in the Drift for foundations of additional buildings at the University of Missouri (lat. 38° 57′ N.; long. 92° 20′ W.). The altitude is seven hundred and thirty-six feet above the Gulf of Mexico. The University is near the southern margin of a rolling prairie, bounded by the large valley of the Hurkson Creek, excavated out of Lower Carboniferous limestones to a depth of one hundred and sixty feet.

2. *Geological Associations.*—The large valley dates back to the close of the Lower Carboniferous epoch. It was subsequently more or less occupied by deposits of the Coal-Measures, which have since been removed, except in some embayments and tributary ravines. Whilst these deposits are not found capping the limestone walls of the valley, yet remnants occur farther away, beneath the Drift-mantle, over the elevations of the rolling country, as shown in a well at the Gardens, just east of the University, where the Carboniferous shales have a thickness of

[1] Read before the New York Meeting of the American Association for the Advancement of Science.

thirty-two feet (Professor Tracey). The country to the north is more or less underlaid by coal-basins. The undulations of this region were produced before the deposition of the Drift, as the denudation which removed the Coal-Measures excavated water-courses out of the limestones. To these undulations the Drift conforms, and where cut through by the streams, these flow upon limestone-beds, the higher layers of which abound in chert.

3. *General Character of the Drift.*—At the University Gardens the thickness of the Post-Pliocene deposits reaches twenty-nine feet; at the University, more than twenty-two feet; but in the bed of a stream immediately to the westward it thins out. The upper two to three feet consists of highly-calcareous, clayey soil, different from the poorly-calcareous Drift (A, Fig. 1). The Drift consists of a drab, hard, sandy clay, very much cracked and stained with iron,—bright yellow-red; or occasionally with manganese,—bluish-black (Fig. 1). The staining is superficial, and



the mottled appearance has been produced since the deposition of the clay. The clay is rudely stratified, as shown in a wash-out, where a torrent has cut through it (fifteen to twenty feet thick). The lower portion contains fragments of chert from the subjacent rock, and occasional boulders of granite, greenstone, and quartzite, which rarely occur higher in the clay. These boulders seldom reach two feet in diameter, although, eighty to ninety miles to the northward, there is an erratic of about two hundred and twenty-five tons' weight; but the margin of the Drift is not far distant to the southward. Enclosed in the clay,

pebbles of crystalline rocks, from one to four inches in diameter, are occasionally found. In a few places there are concretionary nodules of calcareous matter, similar to those of the loess. There are some included layers of compact blue clay. In one section the remains of a tree were found.

4. *The Mechanical Analysis of the Drift, compared with that of the Local Carboniferous Shale.*—[1]

(*a*) The Drift-clay was found to contain

Free rounded sand,	2–0.2 mm. in diameter	19.8
" " "	0.2–0.1 " "	9.4
Clayey sand,	0.1–0.05 " "	22.8
Clay,	finer	48.0
		100.00

Thus we see that the Drift contains not less than fifty per cent. of free and generally rounded grains of sand, most of which is composed of quartz, with a little that is feldspathic.

(*b*) In the Carboniferous shales there is no distinctly separable sand corresponding to Nos. 1 and 2 of Drift, and none that can be so freely separated as in even No. 3. In short, there are thirty per cent. of sand, at least, in the Drift much coarser and more rounded than that in the local Carboniferous shales, having been transported from the north.

5. *Chemical Analysis of the Drift-Clay* was made by Professor Schweitzer, and found to contain

Silica	77.71
Ferric oxide	3.08
Manganic oxide	0.23
Alumina	10.24
Lime	0.38
Magnesia	0.27
Soda	1.525
Potash	0.575
Phosphoric acid	0.02
Carbonic acid	0.64
Water	5.73
	100.40

6. *Sand-Pockets in the Drift.*—Wherever cuttings are made in the Drift numerous irregular sand-pockets are apt to occur. In most of them, however, the sand is mixed with much clay, but

[1] The separation was in a Shöne apparatus.

they are quickly recognized owing to their brighter color, being more highly stained red-yellow than the clay, as the coloring-matter appears to have been an after-deposit in the more porous earth.

7. *Sand-Boulders.*—Besides the irregular sand-pockets there are occasional well-formed, rounded boulders of sand, distinctly separated from the clay. Some sections, exposed in the foundations and drains, were two hundred feet or more in length, and ten to eighteen feet deep, and cut through many sand-boulders. Some of the boulders were three to four feet long by one to one and one-half feet thick (Fig. 4); one was fifteen feet long and three thick (Fig. 2); another thirty feet by six (Fig. 3); and a right-angled segment eighteen feet in diameter was taken out of another (Figs. 1 and 4), whose thickness was eight feet; but on top of the boulder there was a deposit of fine stratified sand one and one-half feet thick.

8. *Character of the Sand-Boulders.*—The sand is generally coarse (the grains being one to five millimetres in diameter), with parallel layers of pebbles (one to two inches in diameter). It contains a little clay, which, together with the surfaces of the grains, is brightly stained with iron. The boulders usually lie horizontally, but occasionally they are found thrown upon their edges (Figs. 1 and 4), either in the clay, or, rarely, upon another boulder. Where the boulders have been jammed together they are broken or coalesce. The jamming has caused the boulders to be deposited in various positions, bearing no relationship to the direction of the movement of the pack. These masses of sand cannot be mistaken for decomposed sandstone erratics. Owing to the general occurrence of sand-pockets and boulders scattered through the clay, most of the brick walls built upon the clay foundations are liable to crack, as some portion of them rests upon the yielding strata.

9. *Origin of the Sand-Boulders, and the Subaqueous Origin of the Drift.*—From the stratified character of the sand-boulders quietly resting in the clay, and their rounded form, their subaqueous origin is manifest. The rounded form is the result of the waves wearing and dissolving away the angularity of masses of frozen sand. The transportation was effected by coast and floeberg ice, into which the sandy masses were frozen. The smaller masses of sand commingled with the clay were deposited from

the broken ice-carriers crushed in the jams of many an ice-pack. The presence of the sand-boulders forced upon their edges, and often broken, bears evidence of the violent action of the wind and waves upon the ice. These floes were stranded or sunken in waters which derived at least a part of their mud from the north. The boulders were generally rounded before their stranding, for often the clay between them does not show any sand derived from the removal of their angularities; yet broken fragments may be seen (as at B in sections). Owing to their porosity the amount of ice necessary to lift the masses would not be many times their volume (except at jams they are rarely less than several feet, at least, apart), as their buoyancy would be greatly increased by the frozen water within them; and we know that the waters of the Arctic seas freeze to a depth of seven to eight feet during the long winter, and fresh water somewhat deeper. The unbroken boulders could not have been pushed along, nor could they have been formed so as to have been transported upon the back or within a glacier. These deposits were probably made in a shallow arm of the sea (cut off by the Ozark ridge rising a few hundred feet higher); yet the waters may have been either brackish or even fresher,—as in the Gulf of Obi to-day,—owing to the amount of fresh water pouring into it; and not in a glacial lake held back by an ice-dam south of a vast, extensive lake. Besides, we know that the Mississippi Valley has undergone considerable oscillation and warping since the Tertiary period.

10. *In conclusion*, the presence of sand-boulders of northern origin, as well as the erratics, deposited in a somewhat stratified, transported clay, is a demonstration that the Drift of Central Missouri is of subaqueous origin.

NOTE.—Dr. E. Andrews has observed similar sand- and gravel-boulders in the Drift through which the lake tunnel was driven at Chicago. Some of these contained brackish or sea water. Other pockets are found at Homewood (twenty miles southward) and elsewhere. However, the Drift in Northern Illinois differs from that in Missouri, and contains less free sand, and an absence of the abundance of broken sand-boulders seen at the latter place.

EDITORS' TABLE.

EDITORS: E. D. COPE AND J. S. KINGSLEY.

WANTED: A definition of a "Philosophical Instrument." "Go to the dictionary," did you say? The definition there found is of no use for present purposes. What is wanted is one which the United States customs officials will respect and be compelled to abide by. These self-sufficient and irresponsible agents of the people have their own views on the subject, and their decisions would be amusing were they not so aggravating. There is an instrument known as a hydrometer. It consists of a glass tube, containing mercury in its lower portion, and a scale. This, the ruling says, is a philosophical instrument, and, as such, pays a duty of thirty-five per cent. The same materials combined in a thermometer constitute no longer a philosophical instrument, but a "manufacture of glass," and, as such, pay a duty of forty-five per cent. So far as we have been able to ascertain, none of the instruments used by the biologist are to be ranked as philosophical instruments. Microscopes and microtomes are "manufactures of metal," as ruled by the Washington wiseacres, in opposition to the opinions of the best scientific men of the country.

This question of duty on importations is a serious one for scientific men. It is all very well to talk of protection to American industry, but this tax on the instruments and books of the student of science actually results in the discouragement of knowledge. If the student desire to import for his own use any book in a foreign language,—a book which has not the slightest chance of being reprinted here,—he is met by that tax of twenty-five per cent.,—a rate which, in many cases, is prohibitory. Can it be wondered that every plan for smuggling the desired books is tried? A more reasonable interpretation of existing laws, or, better, a revision and a reduction of the present duties, would tend generally towards the advancement of American science and the promotion of American honesty.

RECENT LITERATURE.

Wolle's Fresh-Water Algæ of the United States.[1]—In the two substantial volumes of this long-looked-for work we have brought together a great mass of useful knowledge, which will long be a monument to the industry and patience of the author. The labor involved in the preparation of the plates alone, with their multitudes of figures, is something enormous, and, when we remember that this work was all performed by the author himself, one cannot help admiring the spirit which prompted the solitary worker to undertake to give to American students the first manual of the fresh-water Algæ of the country. Hereafter the work will be much easier, and whatever defects or omissions are observed in the present book may be much more easily avoided or corrected in future publications. The book thus marks an important advance in this field of botanical science.

The author, in an introductory chapter of about half a dozen pages, discusses the polymorphism of the Algæ, and its bearing upon the system of classification. Many so-called genera and species are but stages in the life-history of higher forms, as has been made out by the researches of recent investigators, notably by Dr. Anton Hansgirg, of the Royal University of Prague. In summing up, our author says, "It is evident that, sooner or later, the whole system of classification must be changed. The present system is altogether too artificial, separating, as it does, many forms, not only into different genera, but into different families and orders, which are genetically connected. Our present knowledge is too imperfect for a complete arrangement. It is important to understand the life-history of not only a few, but of all, the generic forms."

The system of classification adopted is based upon that of Kirchner ("Krypt. Flora von Schlesien," 1878). The author further remarks, upon the system he adopts, that "many genera are still preserved which have literally no worth, but they serve for reference."

The Algæ treated in the book are arranged under three classes,—viz., Rhodophyceæ, Chlorophyceæ, and Cyanophyceæ. The further subdivisions are as shown in the following condensed tabular arrangement:

Class I.—RHODOPHYCEÆ.

Order I.—*Florideæ*. Families.—1. Lemaneaceæ; 2. Porphyraceæ; 3. Batrachospermaceæ; 4. Hildebrandtiaceæ.

[1] "Fresh-Water Algæ of the United States" (exclusive of the Diatomaceæ); Complemental to Desmids of the United States; with two thousand three hundred illustrations, covering one hundred and fifty-one plates, a few colored, including nine additional plates of Desmids. By the Rev. Francis Wolle, member of the American Society of Microscopists. Bethlehem, Pa.: The Comenius Press, 1887. Vol. i., text pp. 364; vol. ii., plates Nos. LIV. to CCX. Price, $10.00.

Class II.—CHLOROPHYCEÆ.

Order II.—*Confervoideæ.* Families.—5. Coleochætaceæ; 6. Œdogoniaceæ 7. Sphæropleaceæ; 8. Confervaceæ; 9. Pithophoraceæ.
Order III.—*Siphoneæ.* Families.—10. Vaucheriaceæ; 11. Botrydiaceæ.
Order IV.—*Protococcoideæ.* Families.—12. Volvocaceæ; 13. Protococcaceæ; 14. Palmellaceæ; 15. Chytridieæ.
Order V.—*Zygosporeæ.* Families.—16. Conjugatæ; 17. Desmidieæ.

Class III.—CYANOPHYCEÆ.

Order VI.—*Schizosporeæ.*—Families.—18. Nostocaceæ; 19. Chroococcaceæ.

It will be observed that the "families" are groups so named in the German sense, and are really co-ordinate with the Benthamian "orders" of ordinary phanerogamic botany. The six "orders" of the book are, perhaps, equivalent to the "Cohorts" of the higher plants as arranged by Bentham and Hooker. This want of co-ordination may confuse some of our American students whose ideas of botanical orders are derived from the common manuals of the flowering plants, in which "order" and "family" are synonymous.

The descriptions are good, both for genera and species. Analytical arrangements of the species are given in many instances where the genera are large. Measurements are freely resorted to in order to give an idea of the size of filaments, cells, spores, etc. The micromillimetre is used exclusively as the unit of measurement. The plates, while not artistic, are, apparently, quite accurate. Some of them are a little too diagrammatic, as, for example, some of the Spirogyræ. The Œdogonia are very well drawn, and are much better than in Cooke's "British Fresh-Water Algæ."

The author deserves the gratitude of American botanists for bringing out this book and placing it within the reach of all, the price being scarcely half of that of the corresponding English work referred to above.—*Charles E. Bessey.*

GENERAL NOTES.

GEOLOGY AND PALÆONTOLOGY.

Scott and Osborn on White River Mammalia.[1]—In this brochure of twenty pages the distinguished Professors Scott and Osborn, of Princeton, have given a preliminary account of their studies of fossils from the classic bad lands of the adjacent regions of Dakota and Nebraska collected by Mr. Samuel Garman for Professor Agassiz's museum in Cambridge. The most important results are as follows: 1. Determination of the foot-

[1] "Preliminary Account of the Fossil Mammals from the White River Formation contained in the Museum of Comparative Zoölogy, Cambridge, Mass." Bulletin of the Museum, vol. xiii. No. 5, August, 1887.

structure of Dinictis, which induces the authors to refer that genus to the Cryptoproctidæ. 2. Determination of the foot-structure of Hoplophoneus, which places the genus in another family,—the Nimravidæ,—in their opinion. 3. The discovery of the pollex in *Oreodon gracilis*, confirming as normal its occurrence in *O. culbertsoni*, previously recorded by Scott. 4. The description of the cranium of Hypisodus. 5. Discovery of the characters of three remarkable new species of Menodus. 6. Discovery of a new and remarkable genus of Hyracodontidæ, named by them Metamynodon, with its species *M. planifrons*. 7. The addition of two new species to Hyracodon.

The discovery of Metamynodon is an important addition to knowledge, and it indicates an advanced point of a line of rhinoceroses with powerful canine teeth in the upper jaw, which first appears in the Eocene, in the genus Amynodon. The authors do not place these genera in the Hyracodontidæ, but propose for them a new family. I, however, think that they cannot be separated from the Hyracodontidæ. Hyracodon exhibits the canine teeth of the upper jaw, but in a reduced condition. In Amynodon, according to Scott, the mastoid bone is exposed on the outer side of the skull.

The true line of ancestry of the rhinoceroses does not come through the Hyracodontidæ, as I showed in 1881.[1] I then regarded the genus Cænopus (Cope) as the ancestral form of the family,[2] as I had already observed the Lophiodontid character in the skeleton of the species then known to me[3] (*C. mitis* Cope and *C. occidentalis* Leidy). Further observations to the same effect are made by Professors Scott and Osborn in the present paper. I have also noticed that the superior premolar teeth in Cænopus do not differ essentially from those of the Lophiodontidæ, and are totally different from those typical of Rhinocerontidæ and Hyracodontidæ.

The transverse crests are united at their inner extremities, as in Lophiodontidæ, and do not continue distinct to the end, as in the two families named, and as is especially shown to be the case in Amynodon and Metamynodon by Scott and Osborn. In some species of true rhinoceroses the transverse crests become confluent on wearing, in consequence of the development of angles or "crochets," but the crests are essentially distinct. In Aceratherium (type, *A. incisivum*) the superior premolars are of the true rhinoceros type. In the *Rhinoceros schleiermacheri* they are, on the other hand, constructed, as in Cænopus, on the Lophiodontid pattern. This species must be, therefore, separated from Ceratorhinus, where I have placed it. Brandt has

[1] Proceedings Amer. Philosophic. Soc., 1881, p. 380: "On the Systematic Arrangement of the order Periosodactyla."

[2] Loc. cit., p. 394.

[3] Bulletin U. S. Geolog. Survey Terrs., 1879, v. p. 235.

already proposed for it the name Dihoplus.[1] It differs from Cænopus in the presence of a dermal frontal horn, according to Brandt. I therefore propose as new the family Cænopidæ, which is distinguished from the Lophiodontidæ by the absence of superior canine teeth. It embraces two genera,—viz., Cænopus, hornless; and Dihoplus, horned.

In Cænopus one of the premolars—the second—has the rhinocerotic structure, in the two species known. In distinguishing this genus I rely on the structure of the superior premolars rather than on that of the anterior foot. I am not able to substantiate my statement that there are but three digits in the manus of *C. mitis*, and Scott finds four in that of *C. occidentalis*. —*E. D. Cope.*

Marsh on New Fossil Mammalia.[2]—About three weeks after the reception of the paper of Professors Scott and Osborn, the number of the journal which contains this essay was received (October 1). We mention this fact, since the two papers partly cover the same ground, so far as relates to the perissodactyle family of the Menodontidæ. Professor Marsh gives some excellent wood-cuts taken from specimens derived from various parts of the West, to which he gives names, referring them to eight species. The first species is referred to the genus Bison, and it may be recognized by the cut, but not by the description. The second is the well-known and abundant *Aphelops fossiger* Cope, which receives the new name Aceratherium acutum. The remaining species are Menodontidæ, which Professor Marsh calls Brontotheriidæ, although Brontotherium has been shown several times to be undistinguishable from Menodus. Two species of the *Symborodon heloceras* group are referred to a new genus under the name of Brontops. This genus, if valid, will stand between Menodus and Symborodon. *Symborodon trigonoceras* Cope next appears under the name "Menops varians." The generic character as given does not differ from that of "Brontops," and the species is undescribed. The *Menodus platyceras* S. & O. next appears as "Titanops curtus" Marsh; no description is given for either genus or species. A second species is referred to the same genus, and a few of the characters are barely referred to. Finally, another new genus and species are named, but most insufficiently described, and no figure is given.

The publication of pictorial scientific papers is praiseworthy, but something more than pictures is necessary to make a paper scientific. And if one does not examine the easily-accessible

[1] Brandt, "Tentamen Synopsis Rhinocerotidum." Mem. Acad. Imp. Sciences St. Petersburg, 1879, vol. xxvi. p. 48.

[2] "Notice of New Fossil Mammals;" by O. C. Marsh. American Journal Science and Arts, 1877, October, p. 323.

types of the work of others, he is very apt to make publications which savor strongly of plagiarism. In any case, however, while a man may do what he pleases with his own money and take the consequences, it is a public scandal that a scientific bureau of the United States government should permit its money to be used in the way indicated in this paper and in others by the same author. —*E. D. Cope.*

Scott on Creodonta.[1]—In this quarto brochure we have descriptions of six species, of which three are new, and of which three are illustrated by plates. A number of important additions to our knowledge of the osteology of the Creodonta are made. The most remarkable specimen described is a nearly complete skeleton of *Mesonyx obtusidens* Cope. From this Professor Scott has made a restoration, which gives an idea of the proportions of this curious animal. It was about the size of the black bear, and had a much less robust skeleton than that carnivore. The brain-case is very small, and the sagittal crest very high. The specimen proves that the genus Pachyæna differs from it in the presence of one more premolar or molar teeth, and of the entepicondylar foramen of the humerus, as well as in the inequality in the length of the limbs. A large new Mesonyx is described under the name of *M. uintaensis.* It is of much interest as coming from the Diplacodon beds, and it probably represents the last of its family.

The genus Didymictis is shown to possess the embracing zygapophyses of the lumbar vertebræ observed in Creodonta generally, thus confirming the reference to that group. The scaphoid and lunar bones of the carpus are shown to be distinct, confirming the reference of this genus to the same suborder. The characters of the foot and brain of Hyænodon are pointed out for the first time. The genus is shown to be five-toed, and plantigrade, and to possess an *os centrale carpi.* The brain is slightly convoluted, and of elongate form. Professor Scott believes the brain-cast figured by Gervais as that of this genus belongs to some other type. He thinks it probable that the scaphoid and lunar bones are united in some of the European species, while in others it is distinct, as in the American species. To the latter he believes De Blainville's name Taxotherium to be applicable.

Professor Scott closes by defining the suborder Creodonta, and by a discussion of its affinities. He believes the group to be distinct from both the Insectivora and the Carnivora.—*E. D. Cope.*

[1] "On some New and Little-Known Creodonts," by W. B. Scott. Extracted from the Journal of the Academy of Natural Sciences of Philadelphia, August 10, 1887.

BOTANY.[1]

The Eastward Extension of Pinus ponderosa Douglas, var. scopulorum.—This pine, according to Professor Sargent, extends throughout the Rocky Mountain region eastward to "the Black Hills of Dakota, Colorado, and Western Texas" ("The Woods of the United States," p. 119). The same statement is made in vol. ix. of the "Reports of the Tenth Census," p. 193. Coulter, in the "Manual of Rocky Mountain Botany," says that it "is found throughout the Rocky Mountains." In one of the maps (No. 12) accompanying Professor Sargent's ninth volume of the census reports alluded to above, the range of this pine is indicated by colors. Its eastern border may be described as a line beginning near the northwestern corner of Montana and running by a somewhat sinuous course to the southeast corner of the Territory, where it swings out into Dakota so as to include the Black Hills; it immediately passes back westward and northwestward into Wyoming to the Rocky Mountains, near the front range of which it then passes southward to Texas, following pretty closely the 105th meridian. This pine, therefore, according to this map, and all the descriptions referred to, reaches its most eastern station in the Black Hills of Dakota, at about 103° of west longitude.

In a recent botanical excursion into the northern portion of Nebraska I found this pine at a number of stations fully three degrees farther to the eastward of the Black Hills. It is abundant along the bluffs of the Niobrara River from near the 100th meridian to near the 102d, and probably much farther westward. On the buttes which abound in Northwestern Nebraska, along the head-waters of the White River, this pine is so abundant as to give them, at a distance of a few miles, a black appearance. In this the buttes of this part of Nebraska resemble the Black Hills. Whether these bodies of pine are connected with the Wyoming forests I have not been able to determine with certainty, not having had time to follow the river farther; but from various apparently trustworthy accounts I am led to believe that there is such connection. Whether these Nebraska pine-forests are connected with those of the Black Hills I have not determined, but think they are not.

Upon the bluffs bordering the Great Cañon, in which flows the Wasahancha Creek, commonly called Long Pine Creek, pines abound. This cañon extends in a north and south direction, on the south side of the Niobrara River, and is about fifteen miles east of the 100th meridian. Inquiries failed to indicate the existence of the pines eastward of this cañon, and I think that we may note this station as the most eastern point reached by this

[1] Edited by Prof. CHARLES E. BESSEY, Lincoln, Nebraska.

species. It is interesting to note that the Indian name of the creek, Wasahancha, is said to mean "where the pines extend far out," as if the Indians had also noted the remarkable eastward extension of the Rocky Mountain pine.—*Charles E. Bessey.*

The Westward Extension of the Black Walnut.—The westward limit of the black walnut (*Juglans nigra* L.) is given by Sargent as Eastern Nebraska and Eastern Kansas ("Woods of the United States," p. 76, and vol. ix. "Reports of the Tenth Census," p. 131). Upon map No. 5, belonging to the census report, the line marking the western boundary of the black walnut area enters Iowa from the north about twenty miles east of the northwestern corner of the State; it crosses the Missouri River into Nebraska a short distance below Sioux City, passes through Lincoln, and enters Kansas on the 97th meridian, where it then bends to the westward, reaching, in Central Kansas, the meridian of 98½° of west longitude, as it does also in Middle Texas.

I wish now to place on record the occurrence of the black walnut upon the Niobrara River and its tributaries in Northern Nebraska as far west as the 100th meridian. Upon the Wasahancha Creek ("Long Pine") it grows abundantly, in company with the Rocky Mountain pine (*Pinus ponderosa*, var. *scopulorum*). I doubt whether these two trees can be found in company anywhere else upon the continent. Each has stretched out a long arm from its forest area, and the two trees have thus come together.

At the station mentioned I saw walnut-trees between two and three feet in diameter, and am informed that, several years ago, a considerable quantity of walnut lumber was manufactured from the trees in the cañon.—*Charles E. Bessey.*

The Iron-Wood Tree in the Black Hills.—Although limited westwardly to "Eastern Iowa, Southeastern Missouri, and Arkansas, to Eastern Kansas, the Indian Territory, and Eastern Texas," by Sargent ("Woods of the United States," p. 95), I recently observed the iron-wood (*Ostrya virginica*), in considerable abundance, upon the head-waters of Rapid Creek, in the Black Hills of Dakota. The trees were not large, but were loaded with their hop-like fruits. It occurs also in Northern Nebraska, upon the Niobrara River and its tributaries, and in the eastern counties along the Missouri River.—*Charles E. Bessey.*

Still Another Tumble-Weed.—The list of plants having the habit of rounding up their stems and branches so as to form a nearly spherical plant body, which at the end of the season breaks away at the root, thus forming a "tumble-weed," must be increased by adding the winged pig-weed (*Cycloloma platy-*

phyllum). This plant grows sparingly about Lincoln, Neb., but along the Platte River it is very abundant upon the sandy soil near the river, and upon land which has, after ploughing, been allowed to lie idle. About Long Pine and Valentine it almost entirely replaces *Amarantus albus*, the common tumble-weed, but at Chadron the latter occurs almost to the exclusion of the winged pig-weed. At a little distance the two plants look exactly alike excepting in color. The winged pig-weed is of a light yellowish-green color, while the other is dark green.—*Charles E. Bessey.*

Botany in the A. A. A. S.—An examination of the daily programme issued by the Association shows that there were seventeen botanical papers presented for reading in Section F. The zoological papers numbered twenty-two. Taking the time estimated by each author as necessary for the reading his paper, one finds that the botanical papers averaged thirteen minutes in length, and the zoological ones seventeen. This would indicate that there is still some work left for the Botanical Club. It should weed out more of the short notes and hastily-prepared papers. Of course, it is not just to say that short papers are necessarily of less value than long ones, or that papers are valuable in proportion to the time they consume in the reading; nevertheless, it remains true that many short papers are so because of the fact that the author did not take time to fully prepare himself.

The Botanical Club appears to have been very successful this year, one hundred and forty members having recorded their names at this meeting, against one hundred and twenty-one at Buffalo, and eighty-five at Ann Arbor. One of those present writes that "every one noticed the prominence which botany has taken in the Association. Yellow badges were numerous. The single hour—a short hour—for a few of the days was too short for the work of the Club. More time could have been profitably given to informal discussions and short notes. The botanical papers of the Association, and of the Club, were numerous and of good quality. The receptions and excursions were well planned, well patronized, and gave an excellent chance for acquaintance and a comparison of methods."

Botanical News.—There have lately appeared English translations of two valuable German botanical works,—viz., "The Comparative Morphology and Biology of the Fungi, Mycetozoa, and Bacteria," by De Bary, and the "Lectures on the Physiology of Plants," by Sachs. Both books are brought out by the Clarendon Press of Oxford.——"The Task of American Botanists" is discussed by Dr. Farlow in a paper in the July *Popular Science Monthly*, which he previously read before the

American Society of Naturalists. The author rightly urges American botanists to work along lines suggested by their surroundings. "In the remoter districts the absorbing work for some time to come must be the collecting of specimens and the accumulation of field-notes." In the older parts of the country the author urges histological study and "the study of the life histories of different plants, more especially cryptogams." The paper deserves to be widely read.——Dr. Farlow's address as vice-president of Section F of the American Association for the Advancement of Science, on "Vegetable Parasites and Evolution," contains much suggestive matter. For the higher parasites,—*e.g.*, the species of Cuscuta,—"they may be regarded as degenerate forms of other phanerogams." As to lichens, the author sees no reason "why we may not consider the gonidia to be what they appear to be,—viz., algæ; and the hyphæ, fungi parasitic on the gonidia." As to the origin of the fungi,—*i.e.*, the group,—the view "which seems to be more in accord with existing facts than any other" is that they have arisen "not from any one primitive group of algæ, but from different groups of algæ at different periods in the progress from below upward." Incidentally, the author gives his reasons for believing that the species of fungi are more numerous than those of the phanerogams.——Late numbers of the *Journal of the Linnean Society* contain Baker's further contributions to the "Flora of Madagascar;" Bateson and Darwin's "Effect of Stimulation on Turgescent Vegetable Tissues;" King's "Observations on the Genus Ficus, with special reference to the Indo-Malayan and Chinese Species;" Massee's "Disease of Colocasia in Jamaica," with an introductory note by Morris; and Bennett's paper on the "Affinities and Classification of Algæ."——In the August *Journal of Botany* Baker continues his "Synopsis of the Tillandsieæ," and Jackson his "Remarks on the Nomenclature of the Eighth Edition of the 'London Catalogue.'" A short paper on the "History of Botany in Japan," accompanied by a portrait of Ito Keisuke, is instructive and entertaining.——An important paper by Voglino, on the Agaricini, appeared in the July *Nuovo Giornale Botanico Italiano.* Microscopical measurements and descriptions of the spores, basidia, and sterigmata are given. ——The August *Journal of Mycology* completes the enumeration and description of the "Septorias of North America."——An important change in the addresses of two of the editors of the *Botanical Gazette* is announced in the August number. Dr. Barnes, having accepted the chair of Botany in the University of Wisconsin, must be addressed hereafter at Madison, Wis Dr. Arthur succeeds Dr. Barnes in the chair of Botany in Purdue University, and must be addressed hereafter at Lafayette, Ind. ——*Bulletin No. 4*, from the Botanical Division of the Department of Agriculture at Washington, contains a list of the "De-

siderata of the Herbarium for North America north of Mexico," including Ranunculaceæ to Rosaceæ. We trust that botanists will very generally respond to the appeal for specimens.

ENTOMOLOGY.[1]

On the Homologies of the Wing-Veins of Insects.—Using the conclusions of Adolph[2] as a starting-point, Redtenbacher[3] has made a very elaborate investigation into the homologies of the veins of the wings of insects; and, although his conclusions may not be generally accepted, they will be of interest to all systematic entomologists. The work treats of each of the orders of winged insects, and is illustrated by twelve plates, upon which are one hundred and sixty figures of the wings of insects. We have space for only a few extracts from the introductory portions of the memoir.

The geologically-older insects have a richer venation than the later-appearing forms. It is evident from this that the oldest insect-forms were provided, so to speak, with a superfluity of veins, and that in the course of development all that were superfluous have been lost. In this way simpler wing-venation has been brought about.

Various views are held regarding the origin of the wings. While some believe the wings to be sac-like prolongations of the body-wall, Fritz Müller calls them lateral continuations of the dorsal plates. Oken, Graber, Gegenbauer, Landois, Palmèn, see in them metamorphosed tracheal gills. Weissmann is of the opinion that the wing-nuclei form themselves out of the peritoneal sheath of tracheal trunks, and only secondarily cause a prolongation of the body-wall.

That the wings of insects are equivalent to the tracheal gills of the *Ephemerid* larva can hardly admit of a doubt. Whether they have arisen out of tracheal gills is still questionable, for it is not beyond the range of possibility that the opposite is the case,—viz., that wings, through metamorphosis, become tracheal gills. It is not only possible, but even probable, that the wings of insects were originally not active, but merely passive, organs of motion, serving, like the pappus of the Compositæ, for example, for the floating and spreading of the progeny to a distance.

The essential nature of a rudimentary wing is a hollow sac, which is filled with blood-liquid, contains nerves and tracheal filaments, and whose two plates do not grow together until the

[1] This department is edited by Prof. J. H. Comstock, Cornell University, Ithaca, N. Y., to whom communications, books for notice, etc., should be sent.

[2] Ueber Insectenflügel, von Dr. G. Ernst Adolph, Nova Acta der ksl. Leop.-Carol.-Deutschen Akademie der Naturforscher. Band xli. Pars II., Nr. 3. Halle, 1879.

[3] Vergleichende Studien über das Flugelgeäder der Insecten, von Josef Redtenbacher, Annalen des k. k. Naturhistorischen Hofmuseums. Band i. pp. 153–231. Wien, 1886.

last moult. According to Adolph, these tracheal filaments represent the foundation of the vein-system,—to wit, of the concave veins; since the course of these, in the rudimentary wing, coincides completely with the net-work of concave veins in the developed wing. Only later is every trachea shut in and closed by chitine-mass, and thereby transformed into a rib. At the same time, according to Adolph, the tracheæ force the two wing-plates apart and beget a *thinning* of the wing-skin, which shows itself, among other ways, by the fact that the wings, in case of pressure or draught, regularly tear along the concave veins. Between these primary or concave veins appear later *thickenings* of the wing-skin, in the form of chitine lines, with which, finally, tracheæ and blood-vessels associate themselves, and which form secondary, or convex, veins. The two sorts of veins stand, accordingly, in direct opposition to each other; since the former is caused by *thinning* and the latter by *thickening* of the wing-skin; and since in the former the trachea, in the latter the chitine-band, represents the primary formation.

A circumstance not brought out by Adolph is that the two forms of veins occupy different superficial layers, since the primary run on a deeper level than the secondary; whence the former may be designated as concave or valley veins, the latter as convex or mountain veins. In the case of a regular succession of veins the transverse section of the wings must accordingly form a zigzag or wavy line, which, even at the first glance, suggests the thought that a folding must be the cause of this appearance.

If, now, one proceeds on the assumption that the wing-plates grow faster than the enclosing wing-sheath, which offers them only a narrow space, it is easily conceivable that the wing must lay itself in tolerably regular folds. And this is the more natural since the primary veins are formed by the thinning of the wing-skin, and, in consequence, most readily suffer bending and notching exactly upon these lines, while the intermediate fields at first appear only slightly convex, but by continued lateral pressure become ever more firmly compressed.

The primitive insect-wing is fan-like,—*i.e.*, formed out of regularly-alternating concave and convex veins. Such a fan, however, could be capable of complicated motions of flight only in case its convex veins, or at least a majority of them, were furnished with separate muscles. Since this, for evident reasons, is inconceivable, there remain only two ways out of the dilemma: either only one part of the wing is moved and the other passively drawn along, or there must take place such a uniting and grouping of the wing-veins that a smaller number of muscles suffice to move the wings correspondingly. In the first case an active flight is impossible. The wing works rather, in climbing, like a kite; in descending, like a parachute. This can be observed in those forms which still show approximately the fan type of wings

(the Saltatorial Orthoptera and Ephemeridæ). In the great mass of insects the second case is true; the veins of the original fan unite themselves into a few groups, which can be moved either independently or together, and yet require only a small number of muscles. The wing is divided, as a result, into a number of parts, which lie one behind another, and are united with each other by a sort of hinge. The latter can consist only of concave veins or folds, as these represent thinnings of the wing-plates.

In case of many insects (Lepidoptera and Diptera) it is a matter of some difficulty to determine the character of a vein. Concave veins often appear convex (subcosta of butterflies), while, on the other hand, convex veins take on the character of concave veins. In cases where concave and convex veins come into close relation, as with the flies, the true character of a vein is often scarcely recognizable. In general, concave veins run deeply, protrude more strongly on the under than on the upper side, cross-veins are frequently interrupted by them, and at the edge of the wing they often end at a re-entering angle, or, at least, into a baying-in of the margin. The convex veins, on the contrary, are, as a rule, swollen; they never interrupt cross-veins, and only exceptionally end in a re-entering angle, but, on the contrary, often cause at the end bayings-out of the wing-margin.

Redtenbacher defines five fields in the fully-developed wing of an insect. These are (1) the costal field, with the costa; (2) the radial field, with the radius and its numerous sectors; (3) the field of the fifth vein, or the medial field; (4) the cubital field, with the cubitus; and (5) the anal field. He also proposes a uniform nomenclature for the venation in all of the orders. The systems of convex veins running in the several fields are designated by the successive odd Roman figures,—*i.e.*, those of the costal field, by I.; of the radial field, by III.; of the medial field, by V.; of the cubital field, by VII.; and of the anal field, by IX., XI., XIII., etc. The concave line (veins or folds) running between the fine convex trunks he designates by the even Roman numerals,—thus, the concave line between veins I. and III. is indicated by II., and that between III. and V. by IV., etc. The several branches of a lengthwise vein are designated by indices appended to the Roman numerals. Arabic odd numerals are used in case of the convex veins, and Arabic even numerals for the concave,—*i.e.*, the sectors of the radius are designated as III_1, III_3, III_5. If, as is frequently the case, concave folds or veins appear between the branches of a convex trunk, they are designated by the Roman numerals of the convex system in question, with an even Arabic numeral added as an index,—thus, a concave vein between III_3 and III_5 is indicated as III_4.

Redtenbacher gives a table showing the equivalents in his system of the terms employed in the various systems in common use.—*J. H. C.*

The Genera of North American Phalangiinæ.—In working over the rich collections of harvest-men belonging to the Illinois State Laboratory of Natural History, in connection with recent European literature, I find that very few of the species described by Wood,[1] under the old genus *Phalangium*, belong to that genus as now restricted by the best European authorities. I have before me specimens of eight of the species treated by Wood (my determinations of all but two of them having been verified, through the kindness of Mr. Charles W. Woodworth, by comparison with the types in the Museum of Comparative Zoology), and I find that *P. dorsatum*, *vittatum*, *nigropalpi*, and *verrucosum*, all belong to the genus *Liobunum* of C. Koch, as defined by Simon.[2] I have also provisionally referred *P. formosum* and *P. calcar* to this genus, though, on account of the projecting inner angle of the palpal patella in the former and the spur-like process on the outer ventro-lateral surface of the femur of the palpus in the latter, they do not appear to strictly belong to it. *P. cinereum* falls into the restricted genus *Phalangium*, and *P. pictum* goes to *Oligolophus*. I suspect that *P. bicolor* and *P. ventricosum* also belong to *Liobunum*.

In this connection, I desire to call the attention of collectors to a simple method by which the genital organs of the Phalangiinæ may be exposed for study,—a fact which aids considerably in their determination, as these organs, especially in the male, frequently have specific peculiarities. If the caudal portion of the abdomen be compressed between the thumb and finger, the genital organs will be pushed out of the genital opening between the coxæ, and, if the specimen be dropped immediately into alcohol, will generally remain exposed. This method of protruding the genital organs was first described by Latreille in 1796, but does not seem to have been known to many later writers. It is very much preferable to the method of dissection described by Wood. I incline to believe that by its use good distinguishing characters can be obtained from the ovipositor, which will aid in separating the females of certain species that closely resemble each other.—*Clarence M. Weed, Illinois State Lab. Nat. Hist., Champaign*, 18th August, 1887.

ZOOLOGY.

Key to the Recent Families of Sponges.—The following "key" is taken from Dr. R. von Lendenfeld's recent paper (*Proc. Zool. Soc. London*, 1886, pp. 558–662, 1887) on the "Systematic Position and Classification of Sponges":

0.	Skeleton calcareous	1
	No calcareous skeleton	6
1.	Entoderm consists exclusively of collar-cells	2
	Entoderm consists of collar- and pavement-cells	3

[1] Commun. Essex Inst., vol. vi. pp. 10–40. [2] Arach. de France, vol. vi. p. 172.

2. Mesoderm thin, gastral cavity irregular. ..... *Asconidæ.*
   Mesoderm thin, radial cylindrical chambers. ..... *Homodermidæ.*
   Mesoderm thick, irregular chambers. ..... *Leucopsidæ.*
3. With cylindrical chambers. 4
   With spherical chambers. 5
4. Chambers radial, opening directly into gastral cavity. ..... *Syconidæ.*
   Chambers opening into exhalent canals which lead into the gastral cavity. ..... *Sylleibidæ.*
5. Exhalents lead into oscular tubes. ..... *Leuconidæ.*
   Exhalents open direct on one side of the lamellar sponge; inhalent pores on the other side exclusively. ..... *Teichonidæ.*
6. With hexact spicules and thimble-shaped chambers. 7
   Without hexact spicules; with spherical or sac-shaped chambers. 16
7. The spicules remain isolated or partly coalesce, afterwards irregularly. 8
   The supporting spicules early coalesce in a regular dictyonid manner. 12
8. Hexaster in the interior. 10
   No hexasters, but amphidiscs. 11
9. Hypodermalia hexact, sword-shaped, with centripetal radial ray the longest; no pinnulæ. ..... *Euplectellidæ.*
   Pinnulæ in the gastral and dermal surfaces. ..... *Asconematidæ.*
   Dermalia without centripetal ray; no pinnulæ. ..... *Rossellidæ.*
10. With numerous pinnulæ. ..... *Hyalonematidæ.*
11. With uncinates. 13
    Without uncinates. 15
12. With radially situated clavulæ ..... *Farreidæ.*
    With radially situated scopulæ. 14
13. Branched and anastomosing tubes; the skeleton-net forming several layers. ..... *Euretidæ.*
    Branching tubular or calyculate, honeycombed; cavities traversed by reticular membrane. ..... *Melittionidæ.*
    Calyculate or expanded, traversed transversely by funnel-shaped canals opening alternately on one or other surface. ..... *Coscinoporidæ.*
    Canals irregular, traversing the dense dictyonal skeleton obliquely or longitudinally. ..... *Tetradictyidæ.*
14. Meandrically winding tubes. ..... *Meandrospongidæ.*
15. With cartilaginous ground-substance and spherical chambers. Spicules polyact, tetract, lithistid, tylostylote, or stylote; never cemented with spongin. Askeletous forms with spherical chambers. 17
    With soft ground-substance, spherical or sac-shaped chambers. Spicules monaxon, never tylostylote, cemented with spongin. Or skeleton composed of horny fibre without proper spicules. Askeletous forms with sac-shaped chambers. 30
16. With lithistid irregular tetraxon spicules. 18
    With tetraxon spicules of irregular shape; askeletous forms with large chambers, which have large outlets. 19
    With monaxon tylostylote spicules. 27
    Without supporting spicules; flesh-spicules, when present, polyact; with small chambers which have narrow outlets. 29
17. Spicules quite irregular. ..... *Rhizomorinidæ.*
    Spicules rod-shaped, with terminal tufts of branches. ..... *Anomocladinidæ.*
    Spicules tetractin, with terminal branches. ..... *Tetracladinidæ.*
18. Spicules chiefly tetracts, with equal rays and candelabra. 20
    Large tetract spicules, with three equal rays lying tangentially in or beyond the surface, and one differentiated radial ray. 23
19. With small inconspicuous ciliated chambers with small outlets. 21
    With large conspicuous ciliated chambers with wide outlets. 22
20. With candelabra. ..... *Corticidæ.*
    With simple tetracts. ..... *Pachystrellidæ.*
21. With scattered tetracts, triacts, diacts. ..... *Plakinidæ.*
    Without spicules. ..... *Oscarellidæ.*
22. Tetracts with differentiated large centripetal ray and large tangential rays numerous 24
    Tetracts with differentiated large centripetal ray rare, with small tangential rays. 26

23.	With spherasters	*Geodidæ.*
	Without spherasters	25
24.	Flesh-spicules euaster and oxyaster	*Stellettidæ.*
	Flesh-spicules spirastrella	*Theneidæ.*
	Flesh-spicules spirula and sigmata	*Tetillidæ.*
25.	Without flesh-spicules	*Tethyopsyllidæ.*
26.	The widened distal ends of the radial spicule-bundles divide the regular subdermal cavities into ectochonæ or vestibules at the entrance of the inhalent canals	*Tethyidæ.*
	Between the distal ends of the radial spicule-bundles ecto- and entochonæ are found	*Sollasellidæ.*
	The inhalent pores lead direct into the inhalent canals	28
27.	With spirastrellid flesh-spicules	*Spirastrellidæ.*
	With sigmate flesh-spicules	*Suberamatidæ.*
	Without flesh spicules	*Suberitidæ.*
28.	With polyact flesh spicules	*Chondrillidæ.*
	Without flesh-spicules	*Chondrosidæ.*
29.	With proper spicules in the supporting skeleton	31
	Without proper spicules in the supporting skeleton	35
30.	With uniformly distributed skeleton reticulation and not very large subdermal cavities	32
	The skeleton consists of a dense axial reticulation and isolated fibres extending from this to the surface. Beneath these very extensive subdermal cavities are situated	34
31.	With gemmulæ; living in fresh water	*Spongillidæ.*
	Without gemmulæ	33
32.	Without flesh-spicules; fibres of the supporting skeleton not spined	*Homorhaphidæ.*
	Flesh-spicules sigmata or spiral, no chelæ	*Heterorhaphidæ.*
	Flesh-spicules chelæ; when absent fibres of supporting skeleton spined	*Desmacidonidæ.*
33.	No chelæ	*Axinellidæ.*
34.	With small spherical chambers and opaque ground-substance	36
	With large sac-shaped chambers and transparent ground-substance	39
35.	Without filaments in the ground-substance	37
	With filaments in the ground-substance	38
36.	Skeletal fibres with thin axial canal	*Spongidæ.*
	Skeletal fibres tubular, with thick pith	*Aplysinidæ.*
37.	Skeletal fibre with thin axial canal	*Hircinidæ.*
38.	Skeletal fibres with thin axial canal; reticulate	*Spongelidæ.*
	Skeletal fibres tubular, with thick pith; dendritic	*Aplysillidæ.*
	No skeleton	*Halisarcidæ.*

The reader is referred to this journal (September, 1887) for Dr. von Lendenfeld's grouping of the families embraced in the foregoing "key" into orders and larger groups. The following list will be found to embrace the most important technical terms introduced by the author or adopted from previous writers:

Astylote, without style-shaped spicules.

Amphidisc, a rod with an umbrella-shaped disk at each end.

Chelæ, anchor-shaped spicules.

Clavulæ, rods pointed at one end and bearing a knob or disk at the other.

Dermalia, dermal spicules.

Diactina, a member of the tetraxonia group of spicules, with three rays.

Dictyonid, the main hexact spicules coalesce, to begin with, in

a very regular manner so as to form a continuous skeleton, as in the suborder Dictyonina.

Euaster, a stellate spicule with stout pointed conic spicules radiating from one point. Occurs only in flesh-spicules.

Gemmulæ. The winter buds or statoblasts of fresh-water sponges.

Hexaster, a star-shaped spicule with six generally equal rays, belonging to the triaxonian group.

Hypodermalia. Dermalia with imbedded radial ray only.

Lithistid, as in the group Lithistida, which has the spicules tetraxon and often branched.

Monaxonia, with one straight or curved axis, rod-shaped, sometimes with lamellar outgrowths.

Oxyaster, a stellate spicule with long, slender pointed rays radiating from one point. Occurs only among flesh-spicules.

Pinnula, a triaxonian star with five or six rays, one of which is highly developed and branched or covered with disks or scales. The opposite ray is smooth or absent; the other four equal (tangential).

Polyact, without definite axes and with numerous rays.

Scopulæ, fork- or broom-shaped spicules consisting of a long shaft traversed by an axial rod, to the distal end of which some slender anaxial rods are attached.

Sigmata, S-shaped irregularly-curved flesh-spicules.

Spheraster, a ball of spicules radiating from a common centre.

Spirastrella, a spicule the numerous rays of which arise from a stout spiral base.

Spirula, a spiral spicule without spines.

Stylus, a rod-shaped spicule pointed at one end and rounded at the other, but not knobbed.

Tetraxona, with four axes radiating from one point. The ends of the spicules lie in the corners of a square pyramid and their derivatives.

Tetractina, a tetraxonian spicule with four rays.

Triaxonia, spicules with three axes and six rays and their derivatives.

Triactina, a tetraxonian spicule with three rays.

Uncinata, a rod with recurved hooks throughout its entire length.

Occurrence of Stizostedium vitreum in the Basin of the Connecticut.—In March, 1887, a small specimen of the above-named species was brought to the Museum of Wesleyan University, having been caught in Little River, a tributary of the Connecticut, in the town of Cromwell, Conn. The specimen was about eleven and one-half inches in length. The find appeared so extraordinary that the fact was communicated to Professor Goode, of Washington. Subsequently the specimen was

forwarded to him, and the identification of the species was confirmed by him. The remarkable interest of the find appears when it is considered that no species of Stizostedium is known in any of the rivers of the Atlantic coast between the St. Lawrence and the Susquehanna. The question has been raised whether the species could have been introduced accidentally in stocking the Connecticut with shad and salmon. This does not seem probable. I am informed by Hon. R. G. Pike, one of the Fish Commissioners of Connecticut, that all the eggs of shad used in stocking the Connecticut have been derived from localities within the Connecticut basin itself. Salmon have been introduced into the Connecticut from the St. Lawrence basin, but no such importation has taken place since 1879. As no instance is known of the capture of Stizostedium in the Connecticut during the intervening years, it is not likely that it was introduced with the salmon. It appears likely that the eggs were carried across from the waters of the St. Lawrence basin to those of the Connecticut basin by becoming attached to the feet of birds. Any one who will observe on the map how close together the tributaries of the two streams come, at a number of localities in Northern Vermont and Southern Canada, will recognize how easily the transfer might be accomplished. It is among the possibilities that a Stizostedium caught by some sportsman in a tributary of the St. Lawrence might have been thrown, still living, into a tributary of the Connecticut.—*William North Rice, Wesleyan University, Middletown, Conn.*

Birds Roosting in a Town.—For several weeks past the large maples and lindens of the centrally-situated court-house square in Media have been literally alive with the birds that come there to roost each night. Just before dusk a continual stream of blackbirds, robins, and English sparrows may be seen coming from every quarter, and all bound for this little grove in the most central portion of the town. By the time daylight fails many thousands (I speak advisedly) of individuals belonging to these different species have assembled, and the commotion among the leaves during the process of settling for the night is something wonderful. If one hits a tree with a stone there is a noise of wings amounting to a perfect roar. Nor is this coming in of birds from the surrounding country for a night's lodging any new phenomenon in Media. Last year a heavy rain one night drowned about one hundred and fifty of them, and the boys the next morning gathered them with much glee. But is this not a remarkable thing, that these birds should seek a roosting-place in the heart of a town, and nightly pass over and reject hundreds of acres of trees where there would appear to be much less probability of their being disturbed? I have heard no satisfactory explanation of the matter, although much has been said con-

cerning it by one and another. Can some of your bird-loving readers tell us the why and the wherefore? For, I doubt not, similar cases are not wanting, there being no new thing under the sun. I am, etc.,

MEDIA, PENN., September 7, 1887. T. C. PALMER.

The Relation of the Dorsal Commissures of the Brain to the Formation of the Encephalic Vesicles.[1]—There are a number of features which are so universally characteristic of the vertebrate brain at its earliest stage of embryonic development that we are justified in considering them as primitive characters of the brain of the vertebrate stem. These are: 1. The constriction of the neural tube into four vesicles, which represent the prosencephalon, the thalamencephalon, the mesencephalon, and metencephalon.[2] 2. The formation of minor folds (*neuromeres*[3]) at the sides of the metencephalon, corresponding to the roots of the *vagus* and other cranial nerves. 3. The three outgrowths from the thalamencephalon forming the paired and median eyes. 4. The diverticulum from the floor of the thalamencephalon forming the hypophysis. The meaning of the second and third of these developmental features is now understood, but, to my knowledge, no adequate explanation has yet been offered either for hypophysis or for the encephalic vesicles. For the latter I offer the following hypothesis: *that the constriction of the brain-roof which gives rise to the four vesicles is for the accommodation of three nerve-fibre tracts decussating dorsally, viz., the superior and posterior commissures and the cerebellum, which in their primitive condition have a serial homology.*

There is considerable anatomical evidence for this hypothesis. It has for some years been held (Pawlowsky) that the *posterior commissure* which traverses the constriction between the thalami and mesencephala is not a commissure in the strict sense of the word, but consists of fibres from the two great tegmental tracts crossing to the opposite side of the brain. Similarly the *superior commissure*, first described independently by Beilonci and myself, also consists of fibres crossing from the thalami to the opposite hemisphere just in front of the pineal stalk. This commissure is almost constantly developed in the Vertebrata, although it has been little noticed hitherto. Finally, the cerebellum, as I have observed in the Urodele Amphibia, in which it is in an extremely primitive condition, is also composed of decussating tracts, uniting the metencephalon (medulla) with the opposite lobe of the mesencephalon. Supporting the anatomical

[1] Abstract read before the New York meeting of the Amer. Assoc. Adv. of Science, 1887, by Dr. Henry F. Osborn.

[2] I do not reckon the epencephalon (cerebellum) as a distinct segment, but as the roof of the metencephalon.

[3] This term has been applied by Dr. Henry Orr, of Princeton, in a paper soon to appear upon the development of the lizard's brain.

evidence is the fact that these three commissures develop nearly if not quite simultaneously, as may be seen in horizontal and vertical sections of the frog's brain, taken in closely succeeding stages. As shown in the accompanying figures, they occupy the three folds which separate the four segments, and appear simultaneously with the anterior commissure. It is noteworthy that the floor of the neural tube, which evidently has no relation with these dorsal commissures, is also the only region in which there are no folds between the vesicles, being interrupted only by the involution of the hypophysis. The inference to be drawn from these facts depends largely upon the question whether there is really a serial homology between the superior and posterior commissures in their primitive condition. If there is, this hypothesis yields some valuable data as to the primitive condition of the encephalon. If there is no such homology between these commissures, there yet remains considerable ground for the supposition that the inter-vesicular folds are simply lines of retarded growth in the walls and roof of the tube to be traversed at an early period by the commissures.—*Henry F. Osborn.*

EXPLANATION OF CUTS.

FIG. 1. Diagrammatic longitudinal section of the frog's brain at an early stage, showing the division of the neural tube into the prosencephalon, *p*; thalamencephalon, *t*; mesencephalon, *m*; and metencephalon, *mt*. The letters are placed in the respective ventricles.

FIG. 2. Camera drawing of a vertical section of the frog's brain at a later stage, showing the dorsal commissures occupying the inter-vesicular folds. *Scm*, superior commissure; *pcm*, posterior commissure; *cbl*, cerebellum; *hph*, infundibulum; *acm*, anterior commissure; *pn*, pineal gland.

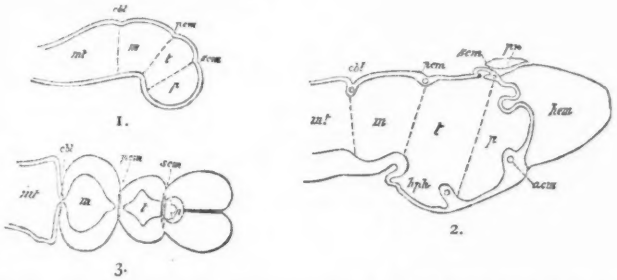


FIG. 3. Camera drawing of a horizontal section of the frog's brain at the same stage, showing the commissures traversing the folds.

The Tongue of Humming-Birds.—In recent ornithological works the tongue of the humming-bird is usually described as a double tube, and is probably used in sucking the nectar of flowers. Recently Dr. Schufeldt has investigated the subject, and in *Forest and Stream* for July 14, 1887, gives the results of his studies. He shows that the account given by MacGillivray in

Audubon's "Birds of America" is correct. The hollow cylinders exist, but each horny tube is completely filled by the cartilaginous rod of the glosso-hyal element, and hence cannot be used in sucking. The tongue is, on the other hand, an instrument for the prehension of small insects. Dr. Schufeldt further states that in not a single cephalic structural particular do the humming-birds agree with the swifts.

On the Morphology of Ribs.[1]—Embryology has shown that the ribs are developed *between* the mesoblastic somits; they are therefore *intervertebral.*

The problem now is, how the different modifications of the position and structure of the ribs derived from that original condition.

If we carefully examine the skeleton of Amia, one of the living Ganoids of this continent, we observe the following: All the centra of the dorsal vertebræ consist of one piece, the posterior part of which shows on each side a process where the ribs are articulated. The same condition is to be seen in the first caudals. From the forty-fourth vertebra a change is beginning. This and the following vertebra consists of two parts,—an anterior disk and a posterior one. The anterior represents the centrum proper, the posterior the so-called intercentrum. Palæontology has shown that in some fishes allied to Amia *all* the vertebræ show the characters of the caudals of that form;[2] and I do not doubt that we will find in young specimens of Amia the dorsal vertebræ divided by a suture separating a vertebra in the anterior centrum proper and the posterior *intercentrum.* In all the dorsal vertebræ the rib is connected with a process of the posterior parts of the centrum,—that is, the *intercentrum.* In the posterior dorsals these processes become smaller, but the ribs are always connected with them. From the thirty-sixth vertebra the ribs unite below. The processes begin to disappear and the ribs are now articulated directly with the free intercentra.

The so-called untere Bogen, lower arches, or hæmapophyses of Amia, *are therefore really the ribs.*

In the first caudal vertebræ we find free spines connected with the distal part of the united ribs; these are co-ossified to those from the forty-seventh vertebra.

As the ribs or pleural arches are homonomous to the neurapophyses, or pleural arches, these spines which may be called *pleural spines* are homonomous to the neural spines; both are supporting the unpaired fins.

The same condition is to be seen in *Lepidosteus*, *Ceratodus*, and *Lepidosiren*,—perhaps in all Ganoidei and Dipnoi.

[1] A paper read before the American Association for the Advancement of Science, August, 1887.

[2] According to a verbal communication of Professor Zittel.

From that fact Gegenbaur reached the general conclusion that the ribs of all vertebrates are nothing else than the modifications of the lower arches, the hæmapophyses; or, reversed, that the hæmapophyses are ribs.

Now, anybody who examines a young skeleton of Alligator or Necturus will find that in the caudal vertebræ *ribs are present besides the lower arches*, hæmapophyses, or chevrons.

That the processes of the caudal vertebræ, which are free in young animals, are true *ribs* can easily be proved on a skeleton of a young Sphenodon.

There are no lumbar vertebræ in Sphenodon, all the presacral vertebræ have well-developed ribs, but the posterior ones are uniting later with the vertebræ. The two sacral vertebræ and the anterior caudals show exactly the same condition; in the young animals the elements are free, but unite later with the vertebræ.

In the caudals we find, besides these ribs, well-developed hæmapophyses, or intercentra. The nature of these chevrons has been examined by Professor Cope and myself: they proved to be nothing else than processes of the intercentra united below; the same processes as those in Amia on which the ribs articulated.

Therefore the lower arches, which enclose the subcaudal blood-vessels, are either formed by true ribs or by processes of the intercentra.

Gegenbaur was wrong in relation to the Stapedifera. Claus was right in that, but did not give any explanation of the condition in fishes.

I shall try to explain all the difficulties.

There is no doubt that the original condition is to be seen in a form like Amia of the Ganoids.

Gegenbaur has shown that in many Teleostei the lower arches are not formed by the ribs, as in Amia, but by processes of the vertebræ, to which the ribs can be articulated. This condition can be seen in the given figures.

Exactly the same must have taken place in the higher Vertebrata. The processes of the intercentra became larger, until they united below, the ribs were pushed out of place and dislocated, not only to the centrum proper but also to the neural arch.

We have on hand all transitions between the caudal vertebræ of a form like Amia and the Teleostei. But the forms connecting the Dipnoans with the same structure of the caudal vertebræ as Amia and the lowest Batrachia, in which the lower arches are formed by the intercentra, as in all other Stapedifera, are still missing.

The Ribs of the Batrachia and Amniota.—In *Archegosaurus* the ribs of the dorsal region are not connected with the well-developed intercentra, but with diapophyses of the neural arches. In the cervical region the articular surface for the rib is continued

downwards, forming a groove on the posterior part of the side of the intercentrum. Therefore the single-headed ribs of Archegosaurus articulate in the anterior region of the vertebræ with both the intercentrum and neurapophysis, in the posterior region with the neurapophysis only.

In the living Batrachia the double-headed ribs are articulated to double-headed diapophyses of the neurapophysis.

Therefore in the Batrachians the ribs have been translocated from the original position on the intercentrum to the neurapophyses.

Whether the Batrachian centrum represents the centrum proper or the intercentrum, as Professor Cope is inclined to believe, cannot yet be determined. *Sphenosaurus* certainly is not a connecting form, but a true reptile, as I have proved.

The Ribs of the Amniota.—Signs of the original condition of the ribs, as seen in Amia, are still preserved in the Permian, Pelycosauria, the Sphenodontidæ, and the Mammalia.

In the Pelycosauria the ribs are connected with the well-developed intercentra; there would be no difference from Amia, if the ribs were not two-headed. A second head is developed, the tuberculum, touching the centrum of the vertebræ. The tuberculum is certainly a secondary development of the rib, going hand in hand with the rudimentation of the intercentrum, giving a better connection to the rib. The rib-articulation in *Sphenodon* is the same as in the Pelycosauria, but the tubercular articulation is more developed, the capitulum in a rudimentary form being transformed to ligament.

The same type we find in the Mammalia, as mentioned by Professor Cope, where the capitular articulation is between two vertebræ in an excavated fossa. The intercentrum has become rudimentary or disappeared entirely.

The one-headed ribs of the Lacertilia, Pythonomorpha, Ophidia, have originated from the condition seen in Sphenodon. The capitulum has gone entirely.

The two-headed ribs of the Ichthyosauria, Crocodilia, Dinosauria, Ornithosauria, have developed from a form like Sphenodon, in which the capitulum was still ossified, but was already transported from the rudimentary intercentrum to the centrum proper. This translocation has gone still further, in a way that both capitulum and tuberculum are at least situated on the neurapophysis.

All stages of this gradual wandering of the ribs can be observed in the vertebral column of a crocodile.

The first vertebra has a single-headed rib, connected with the intercentrum, as in Amia. The posterior dorsal have the two-headed ribs connected with well-developed dia-parapophyses of the neural arch. Between the condition found in the atlas and that in the posterior dorsals all stages can be seen in the intermediate vertebræ.

The results of the present paper are:

1. The ribs are developed *between* the myocomata; they are, therefore, *intervertebral.*

2. The ribs are originally one-headed and connected with well-developed intercentra.

3. All forms and connections of the other ribs can be derived from that condition.

4. The lower arches of the caudal vertebræ are either formed by true ribs, the oldest fishes (Ganoidei, Dipnoi), or by processes of the intercentra (Teleostei, Stapedifera).

5. The connection between the Dipnoans and the Stapedifera is still missing.

6. Some remarks on the nomenclature of the elements of the vertebral column.

Owen's names, "neurapophysis" and "pleurapophysis," are not correct; the neural and pleural arches are no processes of the vertebræ, but are distinct parts.

The two elements composing the neural arch ought to be called the "*neuroids*;" the two elements composing the pleural arch, the "*pleuroids.*"

The spines connected with the neuroids ought to be called, as before, *neural spines;* those connected with the pleuroids, *pleural spines.*

The real centrum of the vertebra ought to be called *centrum;* the lateral elements composing it, *hemicentra* (Albrecht), not pleurocentra.

The name intercentrum ought to be preserved.

The part of the intercentrum, centrum, or neuroid to which the capitulum is articulated, may retain the name *parapophysis;* the part of the centrum or neuroid to which the tuberculum is articulated, may retain the name *diapophysis.*—*Dr. G. Baur, New Haven, Conn.*, 1887.

Zoological News.—LOWER INVERTEBRATES.—Dr. A. C. Stokes describes some more new species of North American Hypotrichous Infusoria in the *Annals and Magazine of Natural History.*

CRUSTACEA.—At a recent meeting of the Linnean Society of New South Wales, Mr. John Mitchell called attention to the fact that some of the Australian species of trilobites of the genus Acidaspis differ from the diagnosis of the genus in having the eyes faceted (not smooth) and the facial suture discontinuous.

Dr. W. Lilljeborg, of Upsala, has worked up the Entomostraca collected by Dr. Leonard Stejneger in his late expedition to the Commander Islands. The results appear in the *Proceedings of the United States National Museum.* Only two new species, *Eurycercus glacialis* and *Diaptomus ambiguus*, are described. *Calanus cristatus* Krŏyer is reported as exceedingly abundant, their dead bodies forming long windrows on the beaches.

MYRIAPODS.—Mr. Chas. H. Bollman has recently published several papers on North American Myriapods. One, entitled "Notes on the North American Lithobidæ," appears in the *Annals of the New York Academy of Sciences*. In it he describes as new *Lithobus minnesotæ, tuber, proridens, pullus, trilobus, cardinalis, howei, politus* (McNiell MS.), and *clavus* (McNiell MS.). This is followed by a synonymical list of the known species of North American Lithobidæ and Scutigeridæ. A second paper—"Notes on North American Julidæ"—appears in the *Annals of the New York Academy* (vol. iv.). The author catalogues ninety-two species of the family known from North America, including the following new species: *Julus oweni, Spirobolus pensacolus, S. hebes, Parajulus ellipticus, P. castaneus, P. obtectus, P. varius*, and *Nanolene* (nov. gen.) *burkei*.

FISHES.—Jordan and Eigenmann, in an account of a collection of fishes from Charleston, S. C. (*Proc. Nat. Mus.*, 1887), enumerate fourteen species, nine of which were not previously known from that locality.

In a paper on the fishes of Kansas, Prof. O. P. Hay describes as new *Notropis æneolus* and *N. germanus*, and suggests that the genus Tirodon Hay was founded on a specimen of *Hybognathus nuchalis* with abnormal dentition.

C. Eigenmann and Jennie E. Hornung contribute to the *Annals of the New York Academy* a revision of the North American species of Chætodontidæ. They recognize fourteen species distributed in the genera Prognathodis, Chætodon, and Pomacanthus.

BIRDS.—The large collection of humming-birds made by Mr. D. G. Elliot and which formed the basis of his recent monograph has passed into possession of the American Museum in New York City. The museum has also acquired his ornithological library of about one thousand volumes.

Dr. Leonard Stejneger is publishing in the *Proceedings of the National Museum* an exhaustive review of the birds of Japan. In the same journal Mr. Robert Ridgway has recently described a new sub-species of plumed partridge (*Callipepla elegans bensoni*) from Sonora. His material consisted of five specimens.

EMBRYOLOGY.[1]

Spermatogenesis in Mammalia.[2]—The interest which attaches to the development of the spermatozoon, from the stand-point of the embryologist, is not less than that which attaches to the

[1] Edited by JOHN A. RYDER, Ph D., Biological Department, University of Pennsylvania, Philadelphia.

[2] Untersuchungen über den Bau des functionirenden Samenkanälchens einiger Säugethiere und Folgerungen für die Spermatogenese dieser Wirbeltheirklasse. Arch. f. Mik. Anat., xxx., 1887, pp. 49–110. Taf. v.–vii. Von Dr. Carl Benda, Berlin.

development of the ovum (ovogenesis), or of the embryo itself (ontogenesis), since spermatogenesis and ovogenesis are processes which involve the maturation of the elements which enter the formation of the fertilized ovum or oösphere. All of these processes are therefore properly comprehended under ontogeny or embryology in its widest sense.

Dr. Benda's carefully-elaborated memoir deals with the development of the spermatozoa in *Sus*, *Mus*, *Lepus*, *Cavia*, *Bos*, *Canis*, and *Felis;* the peculiarities in each case are figured and discussed by the author, but the present writer must content himself by giving a *résumé* of the results and conclusions. The following is a synopsis of Dr. Benda's conclusions, as nearly as possible in his own words:

1. The seminal tubuli of the mammalian testis contain two kinds of histological elements, which are distinct in function,—the *Stammzellen*, or spermospores, with their derivatives (mother-cells, spermatoblasts, etc.), and the "supporting cells" (H. H. Brown), or Fusszellen (Benda).

2. Their functional activities are exhibited in four acts,—1. The multiplication of the *Stammzellen* (spermospores); 2. The production of spermatoblasts from a part of the spermospores; 3. Copulation or union of the "supporting cells,"—*Fusszellen* with a number of spermatoblasts; and 4. The conversion of the spermatoblasts, which have united with the supporting cell, into spermatozoa.

3. These four processes take place successively and continuously (*schübweise*).

4. The multiplication of the spermospores is effected by indirect cell-division in the outer cell-layer of the seminal tubule.

5. The production of a crop of spermatoblasts follows preparatory changes of place of the spermospores and their conversion into substitutional mother-cells (*Ersatzmutterzellen*) and mother-cells through indirect cell-division in the inner cell-layers of the seminal tubuli.

6. After the formation of a generation of spermatoblasts, each of the functional "supporting cells," which lie next the outermost wall of the tubuli, conjugate with or become joined to a number of spermatoblasts.

7. Simultaneously or immediately after this conjugation has been established, the spermatoblasts are converted into spermatozoa.

8. This metamorphosis of the spermatoblasts consists in the conversion of their nuclei into the various organs of the spermatozoa, and the solution of the cell-body or their investment.

9. The rudiments of the organs of the spermatozoon arrange themselves with reference to the point of conjugation, in that the nearest part of the nucleus will become the head and the remotest the tail.

10. The spermatoblasts, during the entire metamorphosis, remain in organic union with the supporting cell, and, through active and passive changes in the latter, are formed into a bundle of spermatozoa.

11. The extrusion of the spermatozoa from the wall of the tubule follows spontaneous or active severing of their connection with the supporting cell, and by lateral pressure from the growing adjacent elements.

12. The various acts of secretion, in every portion of the tubuli, overlap in an orderly manner, and in such wise that at definite points the successive phenomena coincide in time.

If we assume the period of metamorphosis of a spermatoblast as a measure of time, we have

a. The close of each period of metamorphosis of the spermatoblasts marks the beginning of the multiplication of the spermospores.

b. The beginning of the period of metamorphosis coincides with the preparatory changes in the spermospores for the production of spermatoblasts.

c. The preparation for the production of spermatoblasts always corresponds to two periods of metamorphosis; and there are also always two crops in process of formation.

d. With the close of each period of metamorphosis there corresponds a generation of spermatoblasts, so that at the close of the metamorphosis, in the same tubule, the material for the next period lies in readiness.

13. In every portion of a testicular tubule a periodic secretion of spermatozoa and an uninterrupted succession of periods of secretion is possible.

14. The periods of secretion in different tubules do not coincide.

15. By means of a uniform alternation of the periods of secretion in the different portions of the tubuli, the conditions are supplied for a continual secretion of semen by the whole testis of a mammal.

PSYCHOLOGY.

Scientific Theism.[1]—In this book by Dr. Abbot we have an attempted reconciliation between Science, Philosophy, and Religion, in accordance with the scientific doctrine of evolution. As one of the first, if not the first, rational endeavor in this direction, from the stand-point of Philosophy, the book is a noteworthy one. The subject is treated of under three divisions, —viz., a long historical introduction; a part I., on the "Philosophy of Science;" and a part II., on the "Religion of Science." The position of the author is that of Scientific Realism, or Relationalism, as he terms it, as opposed to Idealism or Phenom-

[1] "Scientific Theism;" by Francis Ellingwood Abbot, Ph.D. Boston: Little, Brown & Co. 2d edition; 8vo.

enism. This Realism is not that of the Schools, but is intermediate between it and its opposed Idealism. In other words, relations are not regarded in the wholesale manner in which they were treated by the Idealists, who asserted them to be purely subjective, and by the Realists, who declared them to be entirely objective; but they are analyzed scientifically into their essentials, objective realities, and subjective generalizations or ideas. On this eminently sound basis Dr. Abbot harmonizes philosophical and scientific thought. His statement of the leading positions in the controversy is as follows (p. 23):

"1. EXTREME REALISM (*Universalia ante rem*) taught that universals were substances or things, existing independently of and separable from particulars or individuals. This was the essence of Plato's 'Theory of Ideas,' and Plato was the father of extreme Realism as held in the Scholastic Period. Scotus Erigena, who died A.D. 880, was the first to revive this doctrine in the Schools, borrowing from the Pseudo-Dionysius Areopagita.

"2. MODERATE REALISM (*Universalia in re*) also taught that universals were substances, but only as dependent upon and inseparable from individuals, in which each inhered; that is, each universal inhered in each of the particulars ranged under it. This was the theory of Aristotle, who held that the τόδε τι, or individual thing, was the First Essence, while universals were only Second Essences, real in a less complete sense than First Essences. He thus reversed the Platonic doctrine, which attributed the fullest reality to universals only, and merely a 'participative' reality to individuals. Until Scotus Erigena resuscitated the Platonic theory, Aristotle's was the received doctrine in the Schools, and the warfare was simply between those two forms of Realism prior to the advent of Roscellinus.

"3. EXTREME NOMINALISM (*Universalia post rem*) taught that universals had no substantive or objective existence at all, but were merely empty names or words (*nomina, voces, flatus vocis*). Though probably not the absolute originator of this *sententia vocum*, as the doctrine came to be called, Roscellinus, Canon of Compiègne, was the first to give it currency and notoriety, and the Council of Soissons, under the influence of the Realist Anselm, of Canterbury, his chief opponent, forced him, in the year 1092, to recant the tri-theistic interpretation of the Trinity, which he had consistently and courageously avowed. The theory of Extreme Nominalism was thus put under the ecclesiastical ban.

"4. MODERATE NOMINALISM, or CONCEPTUALISM (*Universalia post rem*), taught that universals have no substantive existence at all, but yet are more than mere names signifying nothing; and that they exist really, though only subjectively, as concepts in the mind, of which the names are the vocal symbols. Abailard is claimed by some, but probably incorrectly, as the author of

this modification of the nominalistic view; William of Occam, who died in 1347, seems to have been the chief, if not the earliest, representative of it. The 'Encyclopædia Britannica,' xvi. 284, 8th edition, says, 'The theory termed Conceptualism, or Conceptual Nominalism, was really the one maintained by all succeeding Nominalists, and is the doctrine of ideas generally believed in at the present day.'

"5. Albertus Magnus (died 1280), Thomas Aquinas (died 1274), Duns Scotus (died 1308), and others fused all these views into one, and taught that universals exist in a threefold manner, —*Universalia ante rem*, as thoughts in the mind of God; *Universalia in re*, as the essence (quiddity) of things, according to Aristotle; and *Universalia post rem*, as concepts in the sense of Moderate Nominalism. This is to-day the orthodox philosophy of the Catholic Church, as opposed to the prevailingly exclusive Conceptualism of the Protestant world.

"Thus both Extreme Realism and Moderate Realism maintained the objective reality of genera and species, while both Extreme Nominalism and Moderate Nominalism maintained that genera and species possess no objective reality at all.

"In contrast with all the views above presented, another and sixth view will now be stated, which, taken as a whole, and with reference to the vitally-important consequences it involves, is believed to be both novel and true.

"6. Relationalism, or Scientific Realism (of which *Universalia inter res* may be adopted as an apt formula), teaches that universals, or genera and species, are, *first*, objective relations of resemblance among objectively-existing things; *secondly*, subjective concepts of these relations, determined in the mind by the relations themselves; and, *thirdly*, names representative both of the relations and the concepts, and applicable alike to both. This is the view logically implied in all scientific classifications of natural objects regarded as objects of real scientific knowledge. But, although empirically employed with dazzling success in the investigation of Nature, it does not appear to have been ever theoretically generalized or stated."

In his discussion of Idealism Dr. Abbot shows that no school of this type is or has been consistent excepting that of Hegel, the outcome of which is the well-known "existence and non-existence are identical."

In his section on the "Religion of Science" Dr. Abbot shows that he is on a hot trail; but we think that he does not quite reach his goal. The key to his argument is found in the following passages of the summary of this part of his views (p. 208):

"2. Because (the Universe) is infinitely intelligible, it must be likewise infinitely intelligent.

"3. Because it is at the same time both infinitely intelligible

and infinitely intelligent, it must be an infinite subject, object, or self-conscious intellect."

We do not perceive that the inference expressed in 2 (above) is a necessary one; in fact, it is obtained by a confusion of object with subject; therefore 3 cannot be sustained.

We heartily agree with the following brief survey of scientific philosophy (p. 200): "The dualistic and teleological philosophy of Paley belongs to the past; the mechanical and monistic philosophy of Spencer and Haeckel belongs to the present, but is rapidly moving into the past; the *teleological and monistic* philosophy of the scientific method and the organic theory of evolution belong to the future, and will soon be here." We add to this our own belief that a part of this philosophy is contained in Dr. Abbot's book; that some of the rest of it is also here we will endeavor to show in the next number of the NATURALIST.—*E. D. Cope.*

MICROSCOPY.[1]

The Naples Water-Bath.—Drs. Mayer,[2] Giesbrecht, and Vosmaer have recently constructed a new water-bath for imbedding in paraffine, which differs in many particulars from the one hitherto employed in the Naples Zoological Station. H. Jung, of Heidelberg, furnishes the whole apparatus, including a small water-bath for imbedding under the simple microscope, at sixty-five marks (sixteen dollars and twenty-five cents). In this price the regulator is reckoned at eight marks and each thermometer at two and a half marks. Orders for the water-bath and its accessories are filled by the Educational Supply Co., 6 Hamilton Place, Boston.

This is the most thoroughly equipped water-bath that has thus far been described, and it is admirably well adapted, in size and shape as well as outfit, to those micro-technical uses for which it was designed.

One of the more important improvements in the outfit is the new Bunsen burner (*r*), which consists of a horizontal tube, to one end of which is attached a short, vertical gas-burner. The burner is fixed in a movable stand 3.5 cm. high. The gas-burner only rises to the height of the stand, so that the bath requires to be raised only 4 cm. The bath is thus placed at a height most convenient for work and most favorable to economy of heat. The flame does not smoke, and does not strike back when reduced to its lowest point. With a maximum flame the bath, which has a capacity of 2.5 litres, is brought to a temperature of 60° C. in thirty to forty-five minutes.

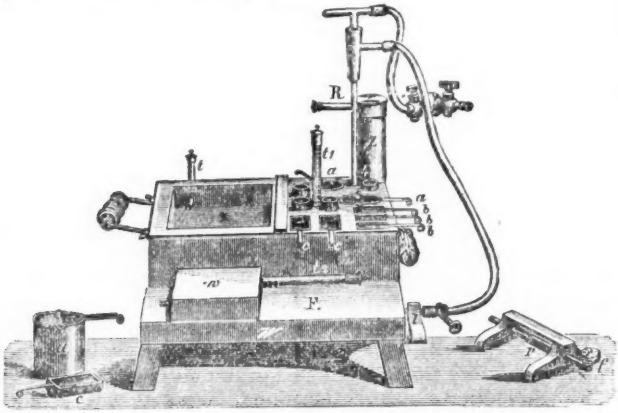
Another important attachment of this water-bath is the thermo-regulator. A full explanation of this part is furnished with each

[1] Edited by C. O. WHITMAN, Milwaukee, Wisconsin.

[2] Dr. Paul Mayer, "Aus der Mikrotechnik," *Internationale Monatsschrift f. Anat. u. Phys.*, iv., H. 2, 1887.

instrument. By means of the regulator the temperature can be kept very nearly constant day and night, the variation being less than one degree with a uniform gas-pressure.

The bath is filled (best with distilled water) through the tube Z, which can be unscrewed for transportation. The tube is made large to guard against the overflow of water during heating, and is covered with a cap to protect aginst dust and to prevent evaporation. While pouring in the water, the bath should be held a little obliquely, so as to allow the air to escape, and the receiving-tube should be left empty.



The deep basins (*a*) are designed for keeping a ready supply of melted paraffine, while the smaller, half-cylindrical basins (*b* and *c*) serve to hold the objects during the process of infiltration with paraffine, or, if the term may be allowed, during the process of *paraffinizing*.[1]

For imbedding very large objects special dishes may be required. Large watch-glasses, or better glass dishes, serve well for such objects, and they can be kept in the large air-bath (*x*). Suitable dishes can also be made by any tinman from white iron-plate. Brass dishes are not recommended, as they are corroded by turpentine.

The air-bath, when kept open, has a temperature about ten degrees lower than that of the water-bath, and is thus a convenient place for the slow evaporation of chloroform, benzol, etc. It is only necessary for this purpose to place the dish containing the paraffine solution and the object on some support (*e.g.*, a cork ring) that will keep it from contact with the bottom or sides of the air-bath.

[1] After the analogy of albuminize, paraffinize would mean to cover, or impregnate, with paraffine.

The small water-bath, for imbedding minute objects under the microscope, has two openings, each of which is connected with a caoutchouc tube about 50 cm. long. The bath is filled by placing one of these tubes in a basin of water and sucking through the other. When the bath is full, the second tube is placed with the first in the basin of water, and the bath is heated on the table (F) or in the air-bath (x), the burner being used, eventually, to aid in bringing the temperature to the point desired. The watch-glass or other glass dish containing the object in melted paraffine is next placed on the bath, with a slip of white or colored paper, according to need, beneath it; and the orientation of the object is then undertaken with the greatest ease. This accomplished, one of the caoutchouc tubes (the lower) is removed from the basin of water and allowed to hang over the corner of the work-table; the hot water is thus drained off and replaced with cold, so that the paraffine cools quickly without the least disturbance of the object.

SCIENTIFIC NEWS.

—The "Circolo degle Aspiranti Naturalisti" of Naples will hereafter be known as the "Societa dei Naturalisti." With this change in name they begin the publication of a bulletin.

—Dr. Pierre, after many years of labor, has completed his work on the Flora of Cochin China. In recognition of this fact the government of the province has granted him a life pension of six thousand francs.

—Dr. W. Zoff has been appointed ordinary professor of botany in the University of Halle.

—Dr. G. Berthold accepts the position of ordinary professor of botany at Göttingen.

—Dr. Karl Brandt, of Königsberg, becomes interim director of the Zoological Institute of the University of Kiel.

—Dr. E. Korschelt, of Freiburg, has been appointed assistant in the Zoological Institute of the University of Berlin.

—In the January number of the AMERICAN NATURALIST we noted the death of Edgar von Harold, one of the authors of the valuable "Catalogus Coleopterorum." Dr. Max Gemminger, his associate in that laborious undertaking, has since died. For many years he had held the position of conservator of the Zoological Museum at Munich.

—Edward T. Hardman, a member of the Geological Survey of Ireland, died in Dublin, April 30. In 1883–86 he travelled extensively in West Australia, and added not a little to our knowledge of the geological features of that region.

—Dr. John Frenzel, of Berlin, sailed July 20 to take the position of professor of zoology and director of the museum in Cordova, Argentine Republic.

—The late Richard Cranch Greenleaf, who died recently in Boston, bequeathed his microscopical library, microscopes, and apparatus to the Boston Society of Natural History.

—The Liverpool marine biological committee has enlarged the field of its operations. The sewage in the neighborhood of the city rendering the study of the fauna and flora a matter of some difficulty, they have, therefore, built a laboratory on Puffin Island, an uninhabited island near Anglesea. The building contains seven rooms and is well adapted for its purposes.

—Mr. James C. Pilling, of the Bureau of Ethnology, has for some time been collecting materials for a bibliography of North American Linguistics. He has now nearly completed the portion relating to the Eskimo languages, and this will be published as a bulletin by the Bureau.

—William Boott, who died in Boston May 16, 1887, was born in that city June 15, 1805. Like his brother, the late Francis Boott, he was a botanist, and devoted himself to the difficult groups of grasses and sedges. His botanical collections go to the herbarium of Harvard University.

—The translation of Reiss and Steubel"s "Necropolis of Ancon, Peru," is now completed, and makes three volumes, illustrated by one hundred and forty-one colored folio plates. A separate volume, complete in itself, is now in preparation.

—W. L. Sclater, of Oxford, England, has been appointed deputy superintendent of the Indian Museum in Calcutta, thus filling the place left vacant by the promotion of Mr. J. Wood-Mason to the superintendency.

—Mr. James E. Humphrey, assistant in the botanical laboratory of Harvard University, has been appointed instructor in botany in Indiana University, Bloomington, Ind.

—Recent Deaths.—Henri Brisout de Barneville, entomologist, at St. Germain-en-Laye, January 23; Thomas Wilson, entomologist, at York, England, April 17; John Gatcombe, ornithologist, at Plymouth, England, April 28, aged sixty-seven; John Hellins, student of British Lepidoptera, at Exeter, England, May 9, aged fifty-eight; Sir Walter Elliot, of London, a student of the Mammalia of India; F. A. Vulpian, physiologist, and secretary of the Academy of Sciences of Paris, May 17, aged sixty-one years; Professor Moritz Wagner, of Munich, a zoological traveller and writer upon evolution, May 31, aged seventy-three years; Robert Gray, the well-known ornithologist of Edinburgh, February 18; Professor Bernard Studer, geologist, at Bern, Switzerland, May 2, aged ninety-three.